Reserve Battery Plate Sizes Used by New York Company—High Turbine Economy under Poor Load Conditions and other articles on engineering Problems of Station and Operating Practice.

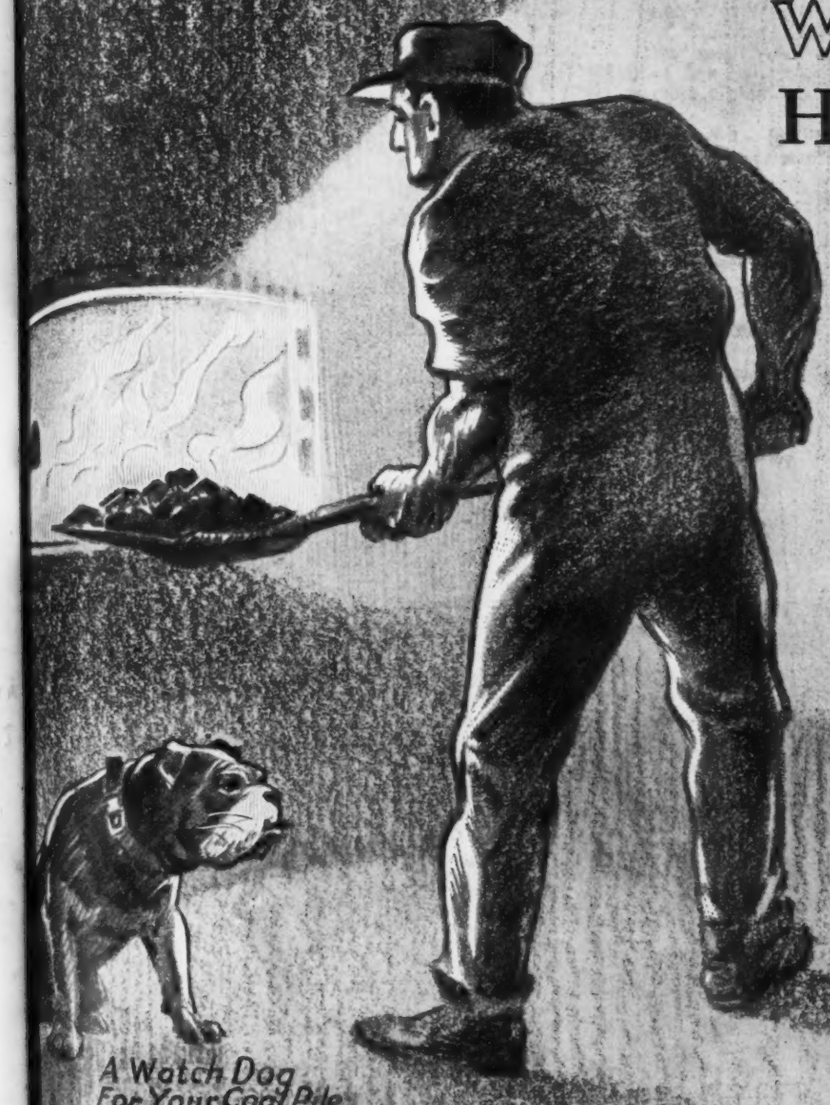
SMITH... UNIV. OF ILLIN...

Electrical World

Volume 68 Number 2 McGraw Publishing Co., Inc. New York, July 8, 1916

Get full returns from the boiler and the coal pile

WORTHINGTON Hot Water Meters



A hot water meter is an essential element of boiler plant economy. Weighing the coal is of little value, if the feed water is not *measured*.

A hot water meter solves the problem of readily finding out the steam-making values of different fuels. If the boiler is overtaxed, or affected by scale or soot, the method of firing inefficient, the furnace defective, or the coal of inferior quality, the fact is reflected immediately in the registration of the meter.

You can depend on a Worthington Hot Water Meter for an accurate, continuous record of boiler plant performance.

Send us your name and address and receive a copy of bulletin W-167-38.

A Watch Dog For Your Coal Pile

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York Works, Harrison, N. J.

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Detroit, El Paso, Houston, Kansas City, Los Angeles, San Francisco, Seattle
Philadelphia, Pittsburgh, St. Louis, St. Paul, Salt Lake City, Denver

W 137.8

Weston

The Interesting History of Weston Instrument Transformers

A very serious problem confronted the Weston Company a few years ago, at the time it had perfected its now world-famous group of A. C. Switchboard Indicating Instruments.

The Company had developed these Instruments to the highest state of perfection, but unfortunately there were on the market no Transformers of sufficient accuracy and serviceability to use in combination with them. Exhaustive tests were made on all types of Transformers available in this market, and the Weston branches and representatives in foreign lands were commissioned to scour the field and send samples of the best Transformers procurable.

Not one of the Transformers thus obtained in this country or abroad even approximately met the requirements.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

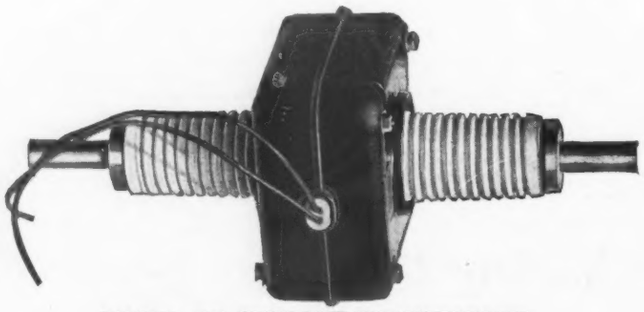
As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

Model 312

PORTABLE INSTRUMENT TRANSFORMER

Weston Switchboard Instrument Transformers described in Bulletin 1501.

Weston Portable Instrument Transformers described in Bulletin 2001.



MODEL 365 CURRENT TRANSFORMER
For Use on 13,200 Volt Circuits.

Home Office and Factory
13 Weston Ave., Newark, N.J.

New York	Chicago
Boston	Detroit
Philadelphia	Toronto
Buffalo	Montreal
Richmond	Winnipeg
Cincinnati	Vancouver
Cleveland	Berlin
Pittsburg	London
St. Louis	Florence
Denver	Paris
San Francisco	Petrograd

Johannesburg, S. Africa

Weston Electrical Instrument Co.

Electrical World

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The User's Viewpoint on Design

DISCUSSION between the engineers who manufacture equipment often gets sidetracked from the main problem. This or that man's way of handling a detail of design is important, but the occasional expression of the user's view on the floor of a convention would often clarify discussion and get the problem at issue back on the main track. What the industry needs is more knowledge of practical performance as well as detail knowledge of designs that will give practical performance. The buyer of heavy equipment, the engineer in the steel mill and the mine, for example, ought to know what he expects a piece of apparatus to do and what he needs better than any other man. He ought to be heard more in discussions at engineering conventions.

Changes in Storage Battery Practice

MR. TORCHIO'S account of the modern methods of the New York Edison Company in installing and using its storage-battery plants speaks very plainly of the improvements in battery practice which have been developed in the last decade. With the growth of great central stations, the introduction of turbo-generators, and the resulting possibility of working at better load factors, with ample reserve to carry the plant over the peak, early storage-battery usage has been greatly modified. For a long time batteries were freely used for service on the peak load, but as the central station has developed, it has come to pass that easier and more efficient ways of handling the peak load have been provided, so that the earlier practice is now neither necessary nor desirable. As at present used in most large plants the storage battery is a reserve for breakdown service, to be used not every day but only occasionally, and then as a rule at a very high discharge rate. In the earlier days batteries were rated on three, six and even eight hours capacity, while now the vital question is what the battery can do for one hour or less. With less frequent and continuous use of batteries has come lessened need for the heavy and exceedingly durable cells required for standing up under regular service for long periods. The present custom of the New York Edison Company is to use much thinner grids, adapted to give very high discharge output, and take the chances on their more rapid depreciation. In point of fact, with the infrequent use the cells now get, the slightly greater rate of depreciation is more than offset by saving in cost and bulk, and in convenience. The present plates give three times the capacity at an emergency discharge rate that could be obtained from the older type of cell. In view of the fact that to preserve continuity of service most efficient battery substations must be put in districts where real estate values are high, the saving in space alone is no inconsiderable matter. At present there are forty-eight battery substations on the New York Edison system, with a total amperage on a one-hour basis of more than 350,000. A one-hour rating to-day is ultra-conservative, and Mr. Torchio gives the figures of ampere rating on the basis of a seven-minute discharge, amounting to more than 1,300,000. Throughout the territory the batteries are held in reserve for emergencies, floating continuously on the system ready to pick up any load that may be necessary. Each battery is taken off weekly for a test charge during the hours of light load to determine its condition, and to give adequate opportunity for the testing of each individual cell. Mr. Torchio's paper is most welcome as giving a résumé of battery practice in its latest phases of development as applied to central station needs.

Legislating Against the Government

LABOR costs, in common with other elements in the expense of manufacturing, have increased. To offset gross increases in labor costs, manufacturers and inventors have put brains and machines to work to make it possible to pay high wages and at the same time keep down unit labor costs. One broad method of accomplishing this double purpose has been the so-called efficiency movement in industry, in which thinking men have fought waste of time and effort by analyzing a piece of work into its component operations and by making it simple and easy to do the work in the quickest possible way. One of the elements in this constructive movement against waste is the time-study. Pressure is being brought to bear once more on Congress in an effort to legislate time-study out of existence in government shops. The Tavenner bill (H. R. 8665) is an example of such legislation. Opposition to time-study follows from a misconception of the motive behind time-study. Every electrical manufacturer interested in bettering his production methods would wish to use time-study to assist him in getting at the facts. Congress would handicap the efficient management of government shops by preventing the free use of one of the real contributions to the art of industrial management in the last twenty-five years. Opposition to time-study is based on a misunderstanding of its purposes. Every congressman should be made to understand that if government establishments are to be efficiently operated, they must have the same opportunities of meeting changing eco-

nomic conditions and wage adjustments which follow, on the same just and scientific basis as private enterprises.

The Station Log and Mathematics

DR. STEINMETZ whose name is associated firmly enough with the mathematical and scientific literature of the industry to free his remarks from the suspicion of bias in favor of that which is solely practical, suggests that an investigator of a breakdown should keep operating conditions of a central station in mind in solving problems of line disturbance. He states that a dirty insulator or a carelessly thrown station switch may be the real reason for so-called transient phenomena, and that we had best stop analyzing transients until we are sure the station insulators are clean. Operating conditions are not as mysterious as transients, but they are very practical elements in determining the reason for breakdowns following sudden rises in voltage. A careless operator may throw the wrong switch and thereby be the unintentional cause of much correspondence between an operating company and a manufacturer's engineer on the mysterious transient voltage phenomena on the line. Before the engineers start to chart the phenomena mathematically, as sometimes has been done, it would be a good thing to find out who threw the switch and when. The station log may have the answer to many an abstruse problem, for a damp, dirty, high-voltage switch bushing may be the reason for a mysterious flashover. The human factor is found in electrical engineering. The best design in the world can be ruined by a careless operator. Let's sort out first these very practical factors before holding an inquest of a damaged transformer with the theories of high frequency.

Timing Relays with a Meter

IN another column of this issue are given the results of some interesting experiments on the use of a standard meter for relay timing to take the place of the customary stop watch. A properly-graduated meter disk is exceedingly easy to read, and when operating on a constant potential circuit the time of rotation is remarkably uniform, particularly if it is used in connection with a resistance of zero temperature coefficient. The times to be measured in relay working may run down to moderate fractions of a second, and in such cases it is almost impossible to determine the time precisely with a stop watch. The reaction time of the operator in starting and stopping the watch comes to be a considerable fraction of the quantity to be measured, and the watch itself generally reads only to fifths of a second at best. It is quite easy to use a meter disk plainly and openly graduated into 100 divisions, properly subdivided, and to catch the time to a very small fraction of a second. In the tests here recorded the value of a single division on the disk was about a fiftieth of a second. Moreover, the eye has practically no perception lag in catching the reading, although the habit of judgment of the observers may vary slightly, so there is every reason to expect the fairly high degree of precision which was found. The cycle recorder used as a check, of course, gave a record which enabled the relative precision of the meter disk and stop watch to be obtained with admirable accuracy, and the results were altogether in favor of the meter disk. Indeed, if the meter were modified by making the recording train with an open scale correspond to that on the disk, time up to several minutes could thus be measured with a satisfactory degree of precision.

Efficiency of Underloaded Turbines

IT has been well understood by engineers that however good the results to be obtained from large multiple-stage turbo-generators operated at favorable loads, there was little to be hoped for small units run underloaded. In fact, for a long time while it was evident that the large units working at high pressure and superheat could beat out reciprocating engines, it was perfectly true that the small turbo-generators, even under fair load conditions, showed steam consumption that would not have been particularly creditable to an old slide valve engine. Inasmuch as in the earlier stages of turbine development the costs still remained high, there was a mighty poor outlook for small turbines. The reason for the relatively low economy of the smaller sizes was inherent difficulty of design, and in addition an effort to secure low cost at a time when the manufacture of turbine units had not settled down to a steady basis.

As time has gone on, however, and experience has been acquired, the outlook is better and the brief article presented in this issue on the performance of a pair of small turbines shows that the situation has been very much improved. The turbines considered are of the geared type, which enables the steam end of the outfit to be designed for a better rotative speed, and hence for better efficiency than if directly coupled. The two plants considered are at Dowagiac, Mich., and Hoopeston, Ill. The first is a municipal lighting plant where the load is less than 50 kw. and operating conditions distinctly unfavorable to economy.

Although the Dowagiac unit has a rating of only 150 kw. it is obvious that the local conditions are abominable, particularly as the steam pressure is only 150 lb. with no superheat. Under these circumstances the plant is lucky in getting off with a little over 32 lb. per kilowatt-hour, including auxiliaries. This record does not look big to the engineer who is wont to think about 5000-kw. units with 200 lb. of steam and superheat, but with a consumption of less than 4 lb. of coal per kilowatt-hour it compares very creditably with many a much more pretentious station. The other plant, that at Hoopeston, is also operated under wretched load conditions, and non-condensing at that.

As everybody knows, running a turbine non-condensing is like shoveling coal into the river, and it is not surprising to find this plant, for which full load steam consumption of 38 + lb. was guaranteed, requiring 9 lb.

of coal per kilowatt-hour in its actual operation. It is only fair to say, however, that this figure will be considerably reduced when a proposed cooling pond is installed and the plant operated condensing. The Dowagiac plant certainly shows that a fair degree of economy on an underloaded small turbine unit is not impossible. The coal consumption of the Hoopeston plant should serve as a scarecrow to warn against working a perfectly respectable and well-intentioned turbine noncondensing.

Water-Power Monopoly and the Market

THE notion exists in the minds of the public and also in the minds of government officials who ought to know better, that a utility gets more than it is entitled to under the economic conditions of to-day. Therefore, the obvious action they take is to repress the utility, curtail its privileges, hamper its development and take from it the hope of return. That such action has thus far been unsuccessful is due more to the wisdom and prudence of the managers of utilities and the basic economic principles underlying central-station work than to the lack of shrewdness on the part of the agitator and zealous believer in a paternalistic government. This is clearly evidenced in the handicaps which are cast in the way of the development of water-powers. It ought to be patent even to a novice that every kilowatt-hour of energy made from water-power means the saving of so many pounds of coal; and when it is considered that coal is used very inefficiently in steam-engine practice any effort to save it should receive encouragement. In the matter of service, it will be conceded that two water-power stations connected together are better than one, and ten interconnected stations still better. Hence the advantage of monopoly of supply in any territory.

In California it has been shown that the more water-power stations there are interconnected to a system the less the necessity for using steam, providing always that there is sufficient water-power available. Nevertheless, hydroelectric development is hampered there. In Montana, without monopolizing the water-power of the State, the electric transmission company has been able on purely economic grounds to get a monopoly of the market. Such a monopoly is presaged on low rates for service which experience has shown to be more reliable than the service displaced. Now, to wait until the market clamors for power is not the habit of central-station men. They are primarily aggressors. They have implicit faith in the power of electricity to do anything that any other form of energy can do and in the vast majority of cases to do it better or cheaper. Like crusaders they go forth to conquer the market. That they displace steam with electricity is not marvelous, especially when they can show such material savings as in the State of Montana. There is no sinister force at work, nothing underhanded or unlawful; the magic is in the electricity and not in the men who sell it. For that reason they cannot comprehend why handicaps should be placed in their path and the right to develop withheld. Eventually no water-power streams will be flowing to waste and electricity will dominate the power field. Then why fight the inevitable?

Service More Important Than Economy

SEVERAL papers at the Cleveland meeting of the A.I.E.E. brought into relief the refinement to which the engineer of operating companies has carried development in protecting circuits. One factor, emphasized in the discussion and deserving of especial record, is the relation between efficiency, economy and service. Improvement in service may be the sole justification of a very large expenditure in experiment, tests and new apparatus. Thousands of dollars have been spent by one large company to eliminate interruptions to service from lightning. The cost of protecting the circuits, to say nothing of the development costs in analyzing the unknown phases of the problem and in experimental work, are far above the money saving in repairs or replacements to damaged apparatus. The motive behind the development is not economy or input-output efficiency. Refinements in practice result in a service which is practically 100 per cent lightning-proof. This investigation is a most valuable contribution to the industry, and a splendid example of enlightened selfishness which dictates the policy of a privately-owned utility. It was pointed out, however, that there is not yet possible a standard of service which can be applied as the ideal for every condition. A thickly-populated community, with customers strung on the company's circuits like beads on a string, presents one set of conditions. A branch line into a thinly-inhabited section involves another group. No thinking judge of service would assume that the refinements possible in one case are essential in all cases.

The Coming Issues

AS previously announced, on July 15 will be published the first issue of ELECTRICAL MERCHANDISING, a monthly magazine dealing with the detail methods of sales, business and merchandising. This expansion of the service of the ELECTRICAL WORLD makes possible at the same time a development of the weekly journal in the broader phases of commercial and business policy. These changes are exemplified in the departments "Commercial and Business Policy," "Wiring and Illumination" and "Review of Trade and Market Conditions." In the first, the ELECTRICAL WORLD will continue to present the broad commercial and business articles which formed a part of the department "Marketing Electricity." Wiring and illuminating engineering practice will be covered in the second department. Market conditions which underlie the general trade and commercial development will be presented in the third department, "Review of Trade and Market Conditions," which is a development of the section "Finance, Commerce and Industry." Next week special articles on general engineering, including descriptions of engineering practice in maintaining service against interruptions, including lightning, will be of timely interest.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Niagara Falls Industrial Campaign for More Power

Electrochemical industries and other great manufacturing establishments along the Niagara frontier are co-operating with the Niagara Falls (N. Y.) Board of Trade in a vigorous campaign which has been launched to obtain more electric power. Every unit of energy generated from the diversion of 15,000 cu. ft. of water a second, the limit permitted by Congress, that can be used is employed, but generating plants cannot meet demands made upon them. The campaign, which is of an educational nature, has been launched in an effort to have Congress increase the diversion to 20,000 cu. ft., the maximum fixed by international treaty. This additional diversion would generate 80,000 hp.

The directors of the board of trade have authorized the publication of literature by the city industrial commissioner giving information regarding power development, and a series of photographs showing that the cataracts will not suffer as a scenic wonder as a consequence of the additional diversion of 4400 cu. ft. Among those co-operating in this educational campaign are A. J. Hooker of the Hooker Electro-Chemical Company, one of the greatest electric industries in the country; Frank J. Tone, Morris Cohn, Jr., I. R. Edmunds, F. A. Lidbury and F. L. Lovelace, secretary of the Niagara Falls Power Company.

Immense quantities of literature, it is said, will be circulated broadcast throughout the country among manufacturers, and especially throughout western New York and among members of Congress in an effort to show how great are the needs for the additional supply of hydroelectric power to the great industries situated at the Falls.

Not to Revoke Export License of Canadian Niagara Company

L. F. Lovelace, secretary of the Niagara Falls (N. Y.) Power Company, denies the report from Toronto that an ultimatum has been served upon the Canadian Niagara Power Company, a subsidiary of the American corporation, to the effect that it must choose between selling almost all the power generated at the Niagara Falls, Ont., plant to the Ontario Hydro-Electric Commission or risk the danger of having its license to export power to the United States revoked. The Ontario government has called for 50,000 hp. to be delivered by next December.

At the present time the Canadian Niagara Power Company is exporting 75,000 hp., most of which is used in Buffalo, 25 miles away. The company has offered the Ontario commission 32,000 hp., the amount available over the block which is now exported. New generators are being added to the equipment of the Canadian generating plant, and it is the expectation of the company to be able to furnish the commission with the desired 75,000 hp. by December. The company expects to have all the new units in operation early next year. All the power the company is exporting to the American side of the river is contracted for, and if the export license is revoked it would seriously cripple many Buffalo industries.

PACIFIC GAS & ELECTRIC REPORT

Gross Revenue for 1915 Amounted to $18,530,301, an Increase of $1,617,613 During the Year

The annual report of the Pacific Gas & Electric Company for the year ended Dec. 31, 1915, shows results of a very satisfactory year. Gross operating revenue amounted to $18,530,301, a gain of $1,617,613 over 1914. Merchandising profits and miscellaneous income were greater than for the previous year by $106,063, the total being $413,879. There was added to surplus $4,212,766, which is $2,645,666 more than the 1914 balance. The corporate surplus, however, was but $716,671, a decrease of $759,650. This was brought about by the 6 per cent dividend declared on the first preferred stock and the 6 per cent common stock dividend. In 1914 the former amounted to but $14,983 and there was no common dividend. There was also an item of $167,017 for miscellaneous adjustments which did not appear in the 1914 figures. On the other hand, the reserves for revenue involved, pending rate litigation, were reduced by $156,074 to $398,288.

The income account for 1915 with comparative figures for 1914 follows:

	1915	1914
Gross operating revenue	$18,530,301.04	$16,912,687.92
Deduct maintenance, operating expenses, taxes and reserves for uncollectable accounts and casualties	9,205,592.61	8,913,921.58
Reserve for depreciation	1,380,000.00	1,000,000.00
Net earnings from operation	$7,944,708.43	$6,998,766.34
Add profit on merchandise sales and other miscellaneous income	413,878.87	307,815.77
Total net income	$8,358,587.30	$7,306,582.11
Bond and other interest	3,985,410.52	4,191,401.39
Balance	$4,373,176.78	$3,115,180.72
Bond and note discount and expense	160,410.43	469,515.01
Balance to surplus	$4,212,766.35	$2,645,665.71

Sales of electricity increased during the year 13.39 per cent, the gross in that department being $9,924,482. Gas, the total sales of which amounted to $7,560,185, showed an increased sale of 7.78 per cent.

The operating revenue of the electric department was derived as follows:

Electric Department	1915	1914	Increase
Commercial and residential business	$4,486,451	$3,973,012	$513,439
State, county and municipal business	787,612	739,083	48,529
Sales of power:			
Agricultural industry	354,171	350,551	3,620
Mining industry	650,740	591,314	59,426
Transportation industry	870,326	756,343	113,983
Manufacturing industry	1,663,099	1,553,640	109,459
Other electric light and power corporations	306,059	304,031	2,028
Commercial and miscellaneous	513,460	487,714	25,746
Panama-Pacific International Exposition—light and power	291,146	.....	291,146
Temporary lighting and power	1,418	3,761	*2,343
	$9,924,482	$8,759,449	$1,165,033

*Decrease.

Fifty-three per cent of the year's gross income was derived from sales of electricity, 40 per cent from sales of gas, 2 per cent from street railway operation and 5 per cent from other sources. Of the total gross operating revenue, 94 per cent was derived from private consumers and the remaining 6 per cent from public purposes. There was an increase during the year of 24,-

840 customers bringing the total served at the close of 1915 up to 403,545. The average gross revenue per consumer was $44.86 in 1915 as against $43.19 in 1914 and $43.78 in 1913. The net gain in customers during the past eight years has been at the average rate of 27,616, or more than 15 per cent per annum.

Total expenses, excluding depreciation, increased $291,671.03. The ratio of these expenses to gross operating revenue decreased from 52.7 per cent in 1914 to 49.7 per cent in 1915, indicating that the larger expenditures were mainly a reflection of the greater volume of business transacted; electric sales, as a matter of fact, having increased by more than 42,000,000 kw.-hr., and gas sales by more than 678,000,000 cu. ft.

MAINTENANCE AND DEPRECIATION

There was charged to maintenance during the year $970,886.37, in addition to which $1,380,000 was set up in operating expenses as a reserve for depreciation, making the total upkeep provision for the year $2,350,-886.37, or 12.41 per cent of the gross revenue for the year; or 12.68 per cent if profits on merchandise sales and other miscellaneous income be omitted from gross revenue. Total upkeep expenditure was equivalent to 11.06 per cent of the gross operating revenue of the year, and compares with an average of 7.21 per cent expended during the same year by seven others of the largest public utilities of the State of California, with aggregate gross operating revenues of $21,945,773.

During the year 1916, $1,500,000 will be set up in operating expenses as a depreciation reserve, in addition to the usual charges for ordinary maintenance. This compares with $1,380,000 set aside for depreciation in 1915. The latter amount is slightly in excess of the annual depreciation calculated for the entire property on the basis of allowances heretofore made in various rate hearings.

The following statement, which is practically on a cash basis, shows the disposition of gross profits during ten years ending Dec. 31, 1915:

DISPOSITION OF GROSS PROFITS DURING TEN YEARS ENDING DEC. 31, 1915

Expended for construction and acquisition of property		$56,474,164.53
Increase in working capital		7,553,964.04
Total increase in assets		$64,028,128.57
Value received for capital stock issues	$12,429,533.32	
Value received for bonds and debentures issued or assumed, less bonds and debentures retired	34,462,660.76	
Assessment of preferred stockholders in 1907	1,000,000.00	
		47,892,194.08
Balance, being amount expended out of gross profits, for construction and acquisition of property and other assets, after using for this purpose the entire net proceeds of $47,892,194.08 from the issue or assessment of capital stock and bonds		*$16,135,934.49
FURTHER DISPOSITION OF GROSS PROFITS		
Rehabilitation of property:		
Repairs of damage by 1906 fire	$2,171,511.03	
Replacement of depreciated property	**6,087,739.88	
	$8,259,250.91	
Discount on gold notes	631,435.37	
Organization expenses	261,032.94	
Expenses in 1908-1910 San Francisco gas and electric company rate cases	64,504.05	
Sundries	56,354.03	
Dividends paid in cash	6,241,318.27	
		15,513,895.57
Gross profits accounted for		$31,649,830.06

*Includes all equities which may be shown in other sections of this annual report to have been created from profits.
**Charged to depreciation reserve $5,886,575.77; to surplus $201,164.11.

Attention is called to the fact that out of the profits of $31,649,830.06 arising from the conduct of the business during the past ten years, after providing for all expenses of maintenance, operation, taxes, bond interest and reserves for uncollectable accounts and casualties, less than one-fifth has been paid out in cash dividends to stockholders, both common and preferred, and more than four-fifths, amounting to $25,408,511.79, has been conserved for the benefit of the property. Of the latter amount $16,135,934.49 has gone to the creation of additional plant and of other tangible assets, and $8,-259,250.91 has, through the rehabilitation and replacement accounts, gone to the preservation of already existing assets; or, to state the matter in another way, for every dollar of cash dividends paid to stockholders during this period, the company has put back into the property for permanent additions and improvements and other concrete assets $2.58, and for the preservation of existing assets $1.32 in addition to $10,954,766 expended for ordinary maintenance.

During the year there was sold to employees, customers and others using within the territory served by the company $3,785,100 of first preferred stock.

SECURITIES OF COMPANY

Since its organization ten years ago this company, directly and through its bankers, has sold, for cash, securities of the aggregate par value of $80,421,400, the entire proceeds of which, aggregating $70,537,705, have been expended solely for the perpetuation and enlargement of this California enterprise. To meet future needs for new capital the company will have available, when and as required and when and as authorized by the Railroad Commission, the following securities issuable only for extensions, additions, betterments, improvements and the refunding of existing obligations, as specified in the public utilities act of California:

General and Refunding 5 per cent Bonds:		
Reserved for retirement of all underlying bond issues	$48,090,800	
Reserved for additions, betterments and improvements at 90% of cost	70,112,200	
In Treasury, available for general corporate purposes	2,900,000	
		$121,103,000
Outstanding in hands of public		28,082,000
Canceled through operation of sinking funds		815,000
Total authorized issue		$150,000,000
First Preferred 6 per cent Stock:		
Reserved for exchange for original preferred stock after July 1, 1916	$10,250,000	
Reserved for additions, betterments, improvements, etc.	27,163,600	
		$37,413,600
Outstanding in hands of public		12,586,400
Total authorized issue		$50,000,000
Common Stock:		
Available for future corporate purposes (including stock owned by subsidiary companies)		$65,964,142
Outstanding in hands of public		34,035,858
Total authorized issue		$100,000,000

NEW PLANTS

There has been no change in the installed capacity of electric plants since the last report. Preliminary steps have, however, been taken for the completion during the year 1916 of power houses Nos. 4 and 5, known as the Halsey and Wise plants, on the South Yuba system, with a combined installed capacity of approximately 30,000 hp. or about the present capacity of the installation now in the Drum power house on the same system. This additional construction is in accordance with the general plan outlined in the annual report for the year 1913, and will enable the company to make a substantial addition to its developed power resources at a comparatively small outlay, as the same water that now operates the Drum power house will also operate power houses 4 and 5 without requiring the construction of additional water storage facilities, canals, etc., above the Drum power house. These power houses will be connected with the general system by steel tower transmission line connected with the present Electra line just above Stockton.

The connected load increased 10 per cent., to 525,541 hp. There was generated in steam plants 166,916,794 kw.-hr., an increase of over 65,000,000 kw.-hr., due

partly to the demands of the Panama-Pacific International Exposition. The efficiency of the steam plants measured by the energy generated per barrel of oil was by far the highest attained since the company's installation of modern turbines, the kilowatt-hours per barrel of oil being 212.34.

CONDITIONS IN MEXICO

Investigation of a Number of Companies Financed by Foreign Capital Shows Reports of Damage to Properties to Be Greatly Exaggerated

Following a recent visit to Mexico, F. H. Phippen and E. D. Trowbridge made a report on a number of light and power and railway properties situated in Mexico and financed by foreign capital. The enterprises covered by this report, which are commonly known as the Pearson Mexican Electric Enterprises, are as follows: Mexico Tramways Company; Mexico Electric Tramways, Ltd.; Ferricarriles del Distrito Federal, S.A.; the Mexican Light & Power Company, Ltd.; the Mexican Electric Light Company, Ltd.; Pachuca Light & Power Company; El Oro Electric Light & Power Company, Ltd.; Mexican Steel & Chemical Company, Ltd.; Officina Electro-Technico de Inspeccion y Comprobacion, S.A. The report states in part:

"As is generally known, the conditions in Mexico have been very much upset during the past several years. We do not feel competent to give an opinion as to when or how these conditions will again become normal, but pending their becoming somewhat fixed, some general basis should be arrived at whereby all of the companies undertake to stand together for the fulfilment of their concession obligations and the maintenance of their properties. When the future of Mexico is reasonably assured the representatives of the various companies will doubtless be able to agree on some basis of reorganization and adjustment fair to all interested. When we left Toronto we were of the opinion that great damage had been done to the physical properties of the companies, particularly to those of the tramways. We were pleased to find, however, that these reports were much exaggerated. We did not attempt to accurately estimate the loss from destruction of property or from depreciation due to lack of repairs.

"Without a careful analysis of the records covering the last eighteen months, it will be difficult to determine how much revenue has been lost by improper operation by the government.

Effect of Lessened Value of the Peso

"The most serious part of the situation, so far as the companies are concerned, is the fall which has taken place in the value of the peso. Under the Mexican laws the consideration of all contracts must be expressed in Mexican currency. This has resulted in placing practically all of the income of the various companies on a paper basis. In normal times a peso was approximately worth an ounce silver or 50 cents. As a peso was 100 centivos this value was usually spoken of as a 2 to 1 basis.

"At the time we visited Mexico the value of the peso had depreciated so that $1 would buy 27 pesos. When we left Mexico three weeks later, it had further depreciated until more than 50 pesos could be obtained in exchange for one American dollar. As the principal part of the companies' supplies must be purchased on a gold basis, the result has been disastrous to their enterprises.

"Naturally it has been impossible to advance wages so as to take care of the decreasing value of the currency. The prices of commodities have gone up almost to a gold basis. This has resulted in a disorganized condition of affairs in general, and has been disastrous to net earnings.

Legal Status

"In spite of the conditions which have prevailed, the legal status of the companies has not been affected. The obligations imposed by the concessions have been carried out, all taxes have been duly paid, and as a whole the record in this respect is clear. It appears reasonably certain, however, that the Mexican peso will not for many years go back to anything like its former value. If this assumption be correct, it may become essential to negotiate modifications of the various concessions. At the moment, however, it is obviously unwise to attempt anything of this kind. Any tariff increases which may be necessary in the near future should be arranged on a temporary basis, and not as permanent alterations of the companies' concessions. The contention can be fairly advanced that as the tariffs were agreed to at a time when the peso had a recognized value of 50 cents gold, the companies are entitled to modifications which will afford substantially a like earning basis.

Mexican Light & Power Company

"When conditions were normal, the revenue of the Mexican Light & Power Company, Ltd., was derived principally from the sale of its power to the Pachuca company, to the mines at El Oro, to the Mexico Tramways Company to the government under contracts for lighting and pumping purposes, and to the general public in and about Mexico City for lighting and power purposes.

"When we visited Mexico the government was largely in arrears for power and neither the Pachuca company nor the tramways was paying anything on account of the power used. The El Oro mines are largely closed down, so that the revenue derived from this source was exceedingly low. The government and the public were paying for lighting and power in paper currency. The employees of the company were receiving an average of 8 cents gold per day, a sum scarcely sufficient to keep a man and his family from starvation. Naturally, they were clamoring for a substantial increase. They were also asking other concessions, such as recognition of the labor union.

"Nothing could be done to increase the El Oro income, as that depends entirely on the operation of the mines. It is probable, however, that at least one of the larger mines at El Oro will shortly resume operations. If so, the income of the company will be substantially increased. The Tramways company at the present moment is not in a position to pay for power supplied.

Government Contends Against Flat Rate

"The Mexican Light & Power Company has for some time past been making flat rate contracts with private light customers; the government has contended that in doing so they were violating their concession. It insisted that the practice must be immediately discontinued, and that some adjustment should be made for previous violations. Soon after our arrival we took up with the Minister of Fomento the question of securing a temporary increase in light and power tariffs in the federal district. We also explained to the department how it was that the company was making flat rate contracts.

"Owing to the low rates at which electric energy is being supplied for light and the high prices of candles and kerosene a very great demand has sprung up in Mexico City for electric current for lighting purposes, on the part of people who formerly used less expensive

kinds of lighting. The company was without funds to obtain the necessary meters to take care of the increased demands; consequently it was compelled either to refuse to take on new customers or take them on on a flat rate basis.

"On this explanation the department agreed to withdraw any claim against the Company arising by reason of these contracts, and to permit the company to continue to make these contracts until conditions in Mexico became more normal. Further it consented to the company increasing the maximum rate allowed by its concession by 100 per cent. These arrangements were made without in any way affecting the company's concession and merely as a tentative measure of relief during existing conditions.

"We endeavored to induce the department to consent to our compelling some of the customers to pay for their power on a gold basis. The department, however, felt that as these prices were governed by existing contracts, and as under the Mexican law the consideration for contracts must be expressed in Mexican currency, it would not be justified in authorizing us to break these contracts and to substitute a gold consideration. The department also felt that the general economic conditions scarcely justified any of the customers being compelled to pay on a gold basis. On the whole we think the department dealt with us fairly and, as far as in its opinion it reasonably could, met our wishes.

"While this is so, the net result is far from satisfactory to the Mexican Light & Power Company. The company is still supplying a very large amount of power to the Mexico Tramways Company without present compensation. The government refuses to increase the rates which it had agreed to pay for power for pumping and federal lighting. These accounts are now being paid by the government, but in paper currency. The small amount realized from the power contracts in El Oro and the cessation of all receipts from Pachuca have left the Mexican Light & Power Company in a position where it is exceedingly difficult if not impossible to maintain its efficiency and meet its actual operating disbursements. We feel that the other companies, whose interests are so closely associated with those of the Mexican Light & Power Company, must devise some method of coming to this company's relief. Notwithstanding these conditions we felt it was absolutely necessary to make a substantial increase in the men's wages. These negotiations were conducted by Mr. Graves, the general manager of the company, and resulted, we understand, in an increase to about 14 cents a day gold at the present value of the peso. It was largely to enable us to make this increase that the Department of Fomento consented to increase our lighting and power tariffs."

The Mexican Light & Power Company, Ltd., was organized in 1903 and acquired concessions granted to the Sociètè de Necaxa for the development of hydroelectric power on the Necaxa River. At a later date other concessions were acquired, and the company now has exclusive rights for the use of the waters of the Necaxa, Tenango, Nexapa, Xaltepuxla, Zempoala, Tasco, Xalaalpam and other rivers, with other necessary rights.

Electric Illumination on the Fourth

Electric illumination this year more than ever before marked the national celebration of Independence Day. While formerly long strings of differently colored lamps hung in festoons along the streets was the most popular form of decorative lighting, this year was marked by the predominance of flood-lighting.

Many cities in response to the wave of patriotism that has swept over the country had laid plans for flood-lighting the local Soldiers' and Sailors' Monument, the first official lighting to take place on the Fourth of July.

Another very prominent feature in this year's illumination on the Fourth was the electrically lighted flag. While this movement has been in progress now for some months, the proper celebration of Independence Day was used as a leverage for making sales and as far as can be found out was successful.

Photo by New York Edison Company

FLOOD LIGHTING OF SOLDIERS' AND SAILORS' MONUMENT

Details of the arrangements made for this public illumination were more or less the same all over the country and for that reason a brief description of the arrangements made for New York City only will be given.

The schedule of the committee on illuminations of the Mayor's Independence Day committee for the Fourth of July called for suitable illumination in the five boroughs of New York. There was a total of approximately 55,000,000 cp. of special lighting which was donated by the lighting companies of the various boroughs. It consisted chiefly of outline lighting and flood-lighting of public buildings and monuments, colored streamers and Japanese lanterns, brightly-lighted bandstands, outdoor moving-picture shows, and neighborhood and settlement

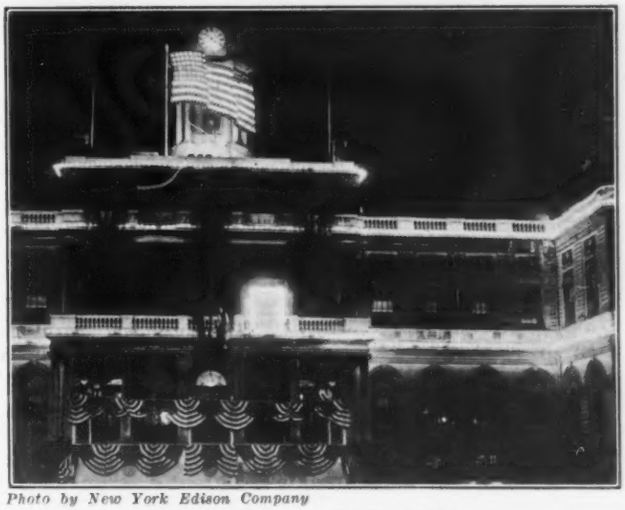


Photo by New York Edison Company

ILLUMINATION OF CITY HALL

dances in the streets. City Hall glowed with 126,000 cp. of light and the Soldiers' and Sailors' Monument on Riverside Drive had a battery of powerful flood illumination turned on it from all sides, bringing out its beautiful architectural features. The light on the monument totaled 1,100,000 cp.

More Business for the Electrical Exporter

Co-operation in Foreign Trade Will Give Us World Markets—Russia Offers a Vast Field for Our Products, Says W. S. Kies

EIGHTH IN A SERIES OF "TALKS IN THE INDUSTRY"

By Frederic Nicholas

International conditions have changed for the American electrical manufacturer. The European war has revolutionized markets, buying habits and opportunities. What it has done already indicates the greater changes which it means in the future. The American International Corporation is one of the opportune developments which show the keen appreciation of trade expansion possibilities. William S. Kies, vice-president of this corporation, and also a vice-president of the National City Bank of New York, has given the Electrical World *an interview pointing out the need of Congressional action in order that the proffered opportunity may not be lost.*

"THE opportunities and problems of the present situation in the commerce of the world have a bearing of almost critical importance upon the future of the United States as a manufacturing nation," said Mr. Kies. "Either we as an industrial nation will look beyond the immediate prosperity of the moment and after careful planning on a large scale get to work to make good our great trade opportunity, or we will see only the profits of a temporary situation and neglect vastly greater permanent expansion of business in coming years.

"We are now upon the crest of a high wave of money-making in which everybody is participating, and as a consequence there has been an unprecedented demand for every kind of merchandise here at home, so that hundreds of manufacturing plants are in operation twenty-four hours in the day. This has been an outgrowth of urgent 'rush' business having to do with the war. What will happen when the abnormal cause of this phenomenal activity no longer throws wealth upon us?

The Grave Problem of Labor.

"Generally, our manufacturers appreciate the fact that this is only temporary, and are conserving their resources. We do not see much foolish expansion of plants depending upon a war of long duration. Only direct costs of production, including the wages of labor, have been allowed to get away from the proportions of steady, peace-time industry. The labor situation, in its bearing upon the future, is one of the serious features of the time. It demands study as one of our gravest internal problems. Can the manufacturers and their labor forces get together in preparation for a readjustment of things when the end of the war comes? Would it not be wise for manufacturers now to be frankly discussing with their men the subject of wage schedules? In my judgment most industries should have a wage standard with a minimum below which wages shall never go and a system of extra payments automatically advanced with increases in prices, wages thus adjusting themselves to the more generous conditions of times of easy prosperity or to the necessarily close economies of adverse periods. Labor, approached reasonably with such a plan, ought to see its justice and expediency in the face of the uncertainties of the future. A wage adjustment is sure to come. Cannot the adjustment be worked out now as a result of thoughtful co-operation, in advance of the day when actual necessity will compel action, and thus avert the loss inevitable if it be left to the arbitrament of strikes and lockouts?

The Coming Competition

"In many lines of manufacture, intense competition is almost sure to develop immediately upon the making of peace. The certainty of this is so important that no manufacturer in any line can individually afford to ignore it as regards his own products. The outcome of the war will decide what particular lines of manufacture will be most keenly affected, also what form the competition will take. If Germany wins, a study of her competition in the past shows that our manufacturers should be prepared for the most searching competition in every market available to Germany, both here and abroad.

"The question as to what is the best commercial preparedness for the coming competition to be made in a large way, beyond the careful attention to the economies and efficiencies of his own establishment that every individual manufacturer will give, must be answered straightway by co-operation of manufacturers in export associations able to meet foreign combinations on equal terms. Our manufacturers are now much better acquainted with the principles and the methods of handling foreign business than they were before the war. As a nation we have made quite a good advance, even if it be moderate, in our equipment for export selling. Young men have become interested in looking to foreign trade as a career. Our export managers have greatly widened their circle of foreign customers. But we limit our possibilities of handling foreign business to a range of manufactures not nearly as broad as we might sell abroad by the present necessity of going at the foreign market individually. Highly efficient selling organizations are necessary in doing a big export business. It is very costly to organize and maintain these. It is so costly that it throws on the individual manufacturer in many lines a burden of expense that his foreign profits cannot meet. The answer is co-operation—combination if you please—among the manufacturers in doing their export business. Manufacturers can get their selling costs down and divide good profits between them in foreign trade absolutely inaccessible to them on account of the plain arithmetic of salesmen's expenses if they try it individually.

A Co-Operative Foreign Sales Campaign

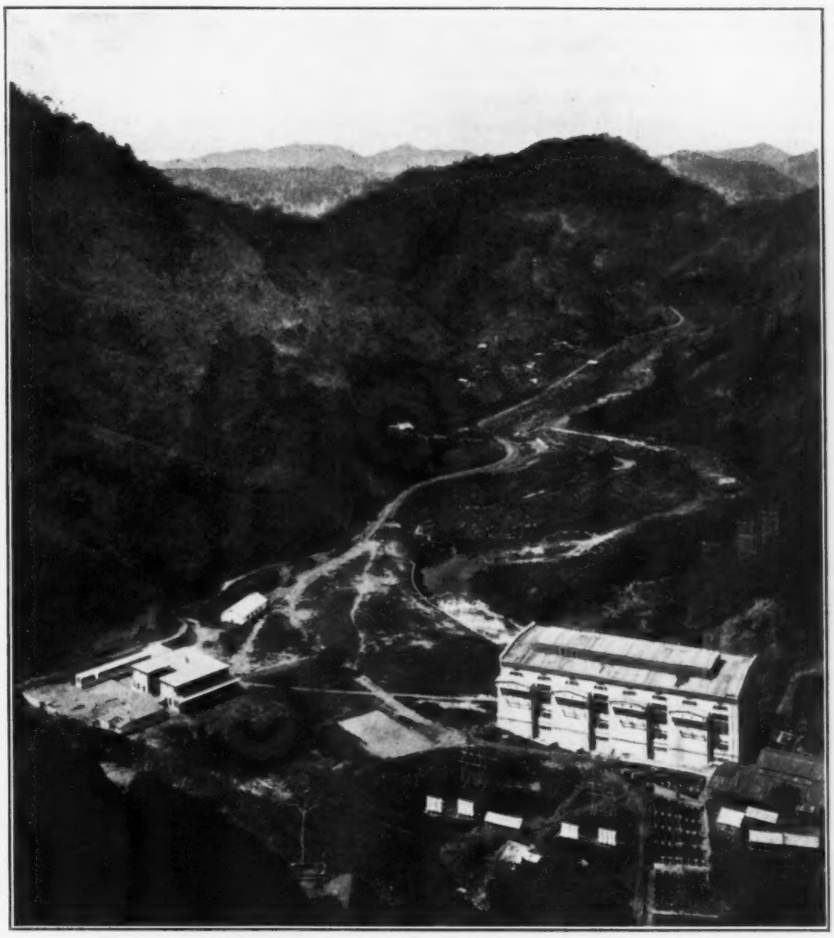
"There are dozens of ways in which combination would be especially effective, apart from the matter of cost. Suppose, for instance, that a number of electrical manufacturers, competing in about the same lines in the domestic market, should get together for a foreign business. They might find a way of cheap manufacture of special export apparatus, bearing a trade-mark owned in common, meeting competition on a price basis in export markets, and giving a back-log for the gradual building up of sales of the special products of American quality manufactured by the different concerns in the combination. Considering the variety of products and designs manufactured in this country, a

co-operative campaign of sales abroad could be made very attractive. It could be made to cost the individual manufacturers a comparatively small amount. It would bring some foreign sales to manufacturers who cannot now reach foreign customers effectively.

LEGISLATION FOR EXPORT ASSOCIATIONS

"There is every good prospect of legislation at this session of Congress that will permit such export associations. The Federal Trade Commission has recommended it in a very able, masterly report. The President has indicated that he is in favor of it. But in the last analysis the question of whether Congress will enact the desired legislation depends on the manufacturers. If they are asleep, we risk the loss of this most important and constructive piece of legislation. Only this action by Congress will save our manufacturers from the necessity of doing as they have done in the past — competing with each other on foreign business, with unnecessary waste of resources and without adequate profit for our capital and labor.

"The present attitude of our manufacturers is in some respects creditable to their alertness and in others a disappointment. Many of them awakened to the possibilities of export trade in 1914 when they were operating at 50 per cent capacity and had no adequate markets for their goods. But now some of them are forgetting about export business in the rush for domestic orders.



GENERATING STATION OF THE RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY, LTD., ON THE RIO DAS LAGES, BRAZIL

This station is equipped with generators and transformers manufactured in the United States.

"There is an immediate market for electrical manufactures among the consumers of South and Central America who heretofore have bought from Europe. There is an ultimate market in the Orient. But the market which Russia offers is even more important, potentially. This is shown by citation of only a few of the items from the Russian official statistics for the year 1913. The value of generators and motors imported by Russia in that year was roughly $4,860,000 of which Germany furnished $4,300,000 and the United States contributed $13,700. Of transformers valued at $397,000, Germany furnished $343,000 and the United States $8,200; of $727,000 electrical measuring appliances Germany furnished the greatest part.

"Furthermore, the manufacture of electrical apparatus within the borders of Russia was in the control of three dominant companies, registered as Russian but in reality owned and operated by powerful interests in Germany. One of these companies had works in Petrograd with thirteen trading branches; another which also had its works in the capital, had nine trading branches; the third, which was a representative of an American electrical manufacturing company, had works in Riga, which have since been moved to the interior of Russia, and seventeen trading branches. Since the commencement of the war all of these organizations have been placed under strict government inspection and their production has been greatly decreased.

"Under existing conditions, two companies in Russia which have no German element in them have greatly increased in importance, but their output of electrical apparatus cannot meet demand as they are filled with government orders for munitions. These companies had a capital of respectively $3,000,000 and $750,000. The more important one has built large new works in Petrograd and Moscow, but it is unlikely that they will be employed in the manufacture of electrical apparatus until after the war.

"When you consider the disorganization of the internal manufacturing facilities in Russia, which are unlikely to be restored to even their former state of activity within a short time after the end of the war, also the fact that the consumption of electrical products is likely to be resumed with at least the volume of imports recorded for 1913, it is clear that there are excellent prospects for American manufacturers. They can profitably investigate the possibilities of establishing manufacturing branches or of seeking the import trade, or both.

WE SHOULD HAVE RECOGNITION

"It is such situations as these I have roughly outlined for Russia and my deep convictions regarding the more internal problems of the United States that lead me to advise electrical manufacturers to seek foreign markets, urging Congress to make it possible to enter them on the same terms with their competitors in those markets in their efforts to get the business. We have the resources, the engineering ability, the organization, trained workers and tested products, and for this skill we should have recognition in the world markets."

High Turbine Economy at Poor Load Factors

How the Use of Double-Nozzle Gear-Type Turbines Has Made It Possible to Obtain High Economies in Two Small Middle West Generating Plants Operating Under Poor Load Conditions

HIGH turbine economies have usually been difficult to obtain in small stations operating at poor load factors because a sufficient number of differently rated generators are not usually installed to permit the operation of such a combination that each machine will carry its full rated load under all conditions. Since the advent of double-nozzle gear-type steam turbines, however, this drawback to high economy operation has been removed, since it is possible to operate these units at almost as high economy below rated load as at full load.

Two installations of this type of equipment, selected for different reasons and carrying loads of unlike characteristics, are referred to in what follows. One of these is operating at the Dowagiac (Mich.) municipal station, and the other at the Hoopeston (Ill.) Gas & Electric Company's station. The first-mentioned installation includes a 150-kw. unit and the second two 300-kw. machines.

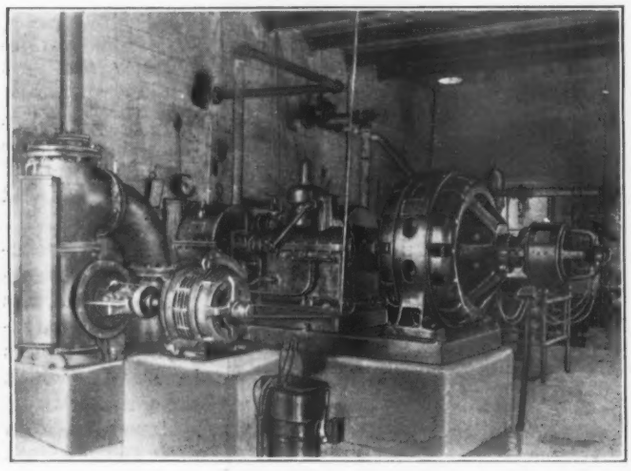


FIG. 1—TWO-NOZZLE GEAR-TYPE TURBINE EXHAUSTING INTO CONDENSER AT DOWAGIAC (MICH.) STATION

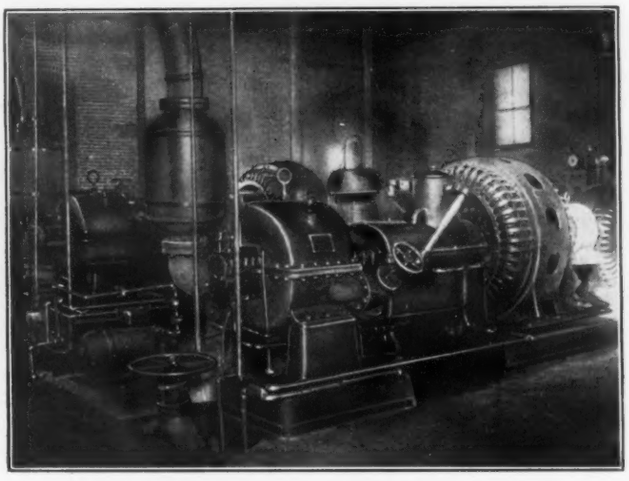


FIG. 2—TWO 300-KW. DOUBLE-NOZZLE TURBINES INSTALLED AT HOOPESTON (ILL.) CENTRAL STATION

Conditions Influencing Selection of Double-Nozzle Turbines

At Dowagiac the selection of size and type of generator units adopted was governed largely by the anticipation of future requirements. The present load amounts to less than 50-kw., and consists entirely of street lighting which is required from dusk to daylight. No commercial customers are served. Looking ahead to supplying the entire electrical needs of the city, however, W. E. Reynolds, superintendent of the lighting department, selected the largest unit that would operate with reasonable economy under the present load conditions.

In the Hoopeston installation, on the other hand, the governing considerations in selecting the prime movers were the widely varying characteristics of the present commercial and street lighting loads which are both of a seasonable nature. Equipment was therefore needed which would operate at good and practically uniform economy under all loads. As indicated by the accompanying water-rate curves, this has been accomplished to a remarkable degree.

The load at Dowagiac consists of 164, 100-cp. and sixty 250-cp. 6.6-amp. series gas-filled lamps operating on a 2500-hr. schedule; nineteen 500-cp. 110-volt, multiple street lighting units operating on a 4000-hr. schedule, and about 7 kw. in public building lighting units. The latter are operated by direct-current energy during the early evening hours or on dark days until the alternating-current machine is started up to carry the street lighting load, when they are switched over on to the alternating-current system.

The Hoopeston load is largely commercial and includes such industries as the Sprague Canning Machine Company, American Can Company, Illinois Canning Company, and the Hoopeston Canning Company, which, one week of last summer turned out $20,000 worth of canned corn, etc., a day. Because of the predominance of the canning industry load the central station peak load, which is marked, comes not at Christmas time, but during the canning season. The importance of maintaining continuity of service in this community is indicated by a remark made to Manager H. D. Hayden by one of his customers, to the effect that if the central station should shut down for one week it would delay three-quarters of the automobile deliveries in the country, because the jacks included in the tool equipment for that number of American cars are made at Hoopeston.

Boiler Room and Engine Room Equipment

The generating equipment at the Michigan station includes a two-nozzle Westinghouse turbine designed for 150-lb. steam pressure and 7200 r.p.m., and is geared 8 to 1 to a 150-kw., three-phase, 60-cycle, 1150-2300-volt, 900-r.p.m. belted-type generator with the exciter mounted on the end of the shaft. The turbine operates condensing, and exhausts into a Westinghouse Le Blanc condenser, for which water is supplied at the rate of 264 gal. per minute at full turbine load by a 10-hp., three-phase, 220-volt induction motor. An old stand-by boiler and a 117-hp. Babcock & Wilcox boiler equipped with a Jones underfeed stoker supply steam for the turbine unit, for hydraulic pumps located in the same

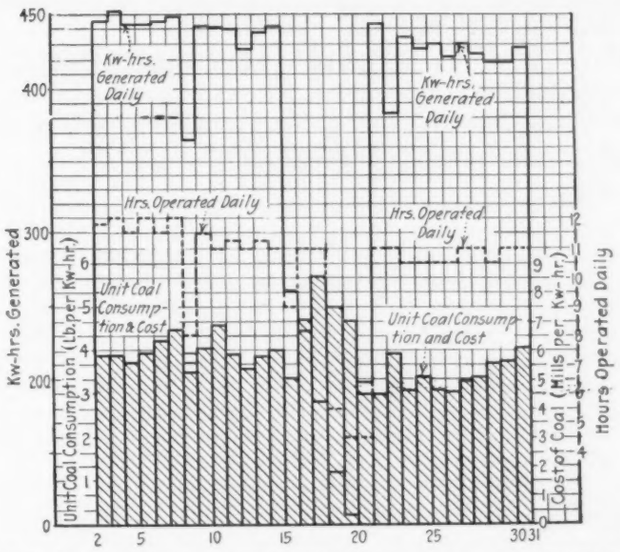


FIG. 3—UNIT COAL CONSUMPTIONS AND COSTS AT DOWAGIAC

building, and for a 10-kw. direct-current, vertical, reciprocating, non-condensing Engberg engine-generator set. The latter exhausts into a feed-water heater and is used to supply energy for any public building lamps which may be required at hours when the turbine unit is not running. This unit is also used for charging a storage battery in the fire engine house. Under the present average load of 45-kw., condenser water at 55 deg. Fahr. is supplied at the rate of 200 gal. per minute, and is discharged into the sewer at 68 deg. Fahr., giving an average vacuum of 28.7 in. of mercury with an average barometer reading of 29 in.

TABLE I.—GUARANTEED STEAM CONSUMPTIONS FOR TWO-NOZZLE TURBINES

Dowagiac — 150-Kw. Unit—Condensing			
80 Per Cent P. F. — 150 Lb. Steam Pressure			
Per Cent Full Load	Kw.	Pounds Steam Per Kilowatt-Hour One Nozzle	Two Nozzles
125	187.5	...	25.7
100	150	...	26
75	112.5	...	27.3
50	75	28.8	30.5
33⅓	50	32.7	...
25	37.5	39.9	...
80 Per Cent P. F. — 125 Lb. Steam Pressure			
125	187.5	...	25.8
100	150	...	26.1
75	112.5	...	27.4
50	75	28.9	30.6
33⅓	50	32.6	...
25	37.5	40	...

Hoopeston — 300-Kw. Units — Noncondensing				
80 Per Cent P. F. — 150 Lb. Steam Pressure				
Per Cent Full Load	Kw.	Pounds Steam Per Kilowatt-Hour Small Nozzle	Large Nozzle	Both
100	300	...	...	38.2
80	240	...	...	41.6
60	180	...	40	47.6
40	120	...	48.4	59.5
30	90	48.7	...	...
20	60	61.4	...	...

The 300-kw. Westinghouse units at Hoopeston are designed for 150-lb. throttle pressure and run 6000 r. p. m.

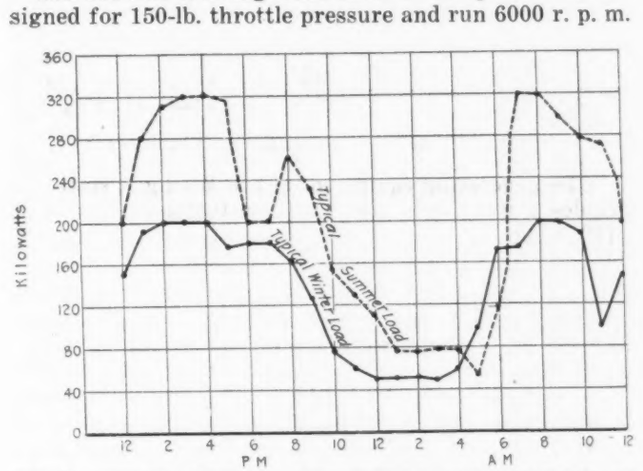


FIG. 5—TYPICAL SUMMER AND WINTER LOADS CARRIED BY HOOPESTON (ILL.) PLANT

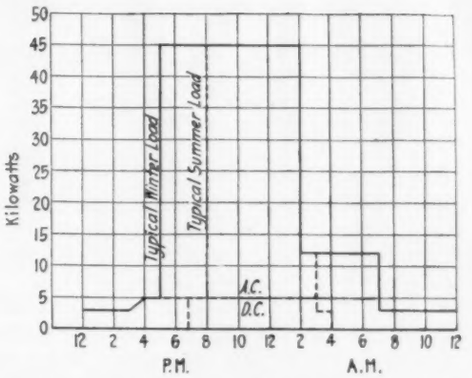


FIG. 4—TYPICAL SUMMER AND WINTER LOADS CARRIED BY THE DOWAGIAC (MICH.) PLANT

non-condensing. The efficiency is practically the same at one-quarter and one-half load as it is at three-quarters and full load. The belted-type generators to which the turbines are geared run at 900 r. p. m., and generate 2300-volt, 60-cycle, three-phase energy, the exciter being mounted directly on the generator shaft as at Dowagiac. The boiler equipment includes three 150-hp. return-tubular Houston, Stanwood & Gamble Company boilers equipped with dutch-oven type furnaces, known as the McMillan semi-automatic, gravity-feed smokeless furnaces. These, in a sense, are hand-fired, since the coal must be shoveled to the top of the dutch ovens by hand and fed from there to the grates by periodic shaking of the latter.

METHOD OF SETTING NOZZLES TO OBTAIN MAXIMUM ECONOMY

The nozzles in the turbine at Dowagiac are set to carry equal loads, while in the Hoopeston plan they are set to carry one-third and two-thirds of the total respectively. Different adjustments are used at these two plants because of dissimilar requirements. At Dowagiac the load is practically fixed and amounts to approximately one-third of the capacity of the machine at 150-lb. steam pressure. Because of this condition the steam pressure is maintained at 125 lb., which reduces the capacity of one nozzle from 75-kw. at 150 lb. to approximately 60-kw., so that the turbine may thus be operated with one nozzle at nearly full load. At any time the capacity of the turbine when operating with one nozzle can be increased to 75-kw. without resetting the nozzles by boosting the steam pressure. The economy is practically the same at 125-lb. as at 150-lb. steam pressure, as shown by the accompanying guar-

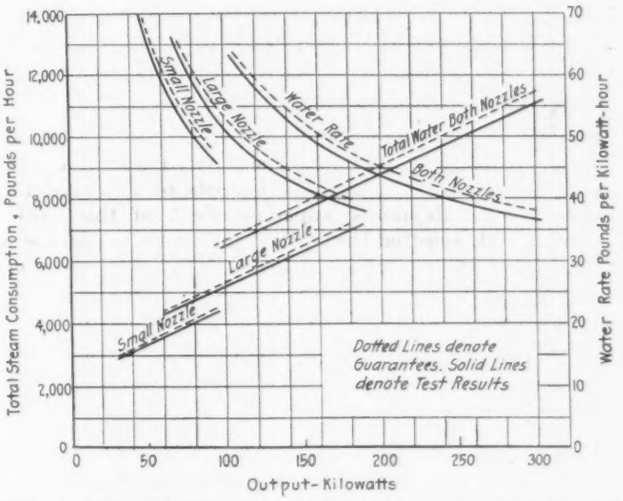


FIG. 6—PERFORMANCE OF 300-KW. 6000 R.P.M. DOUBLE-NOZZLE TURBINE OPERATING NON-CONDENSING AT 150 LB. PRESSURE

TABLE II.—OPERATING DATA ON DOWAGIAC PLANT

Total hours run	309.75
Total kilowatt-hours generated	11,451
Average load per month, kilowatts	37
Average pound coal per killowatt-hour	3.8832
Average cost of coal per killowatt-hour in mills	5.7888
Cost of coal in bins per ton	$3.00

antee figures. This method of operation will permit the addition of a small number of street lamps, after which the steam pressure may be changed, as previously explained, to permit operation at maximum efficiency without alterations in the nozzle setting.

The one-third, two-third setting at Hoopeston makes it possible to operate the 300-kw. units at almost full-load economy on practically all loads. When the load is 100-kw. or less, only the first nozzle is used; when it is between 100 and 200-kw., only the second nozzle is used; while for larger loads both nozzles are used.

WATER RATES OBTAINED UNDER OPERATING CONDITIONS

The guaranteed water rates of the turbine units are given in an accompanying table. The actual operating water rates, however, are slightly better than the guarantee, as indicated by the curves for the Hoopeston units and by operating data for the Dowagiac plant given in Table II. At the latter station the guaranteed water rate for 37.5-kw. at 125-lb. pressure is 40 lb. per kilowatt-hour, whereas the average consumption during one month's operation was actually 32,019 lb. steam per kilowatt-hour, with an average load of 37 kw. This figure was computed by multiplying the average evaporation rate (8.246 lb. of water per pound of coal) for the month by 3.88, the average pounds of coal per kilowatt-hour. It may be pointed out that this steam consumption includes that required to drive the exciter as well as that used to operate the condensing equipment, or in other words, the total steam per kilowatt-hour delivered at the switchboard. Performance data have not been secured under operating conditions for other loads, but it is presumed that the water rates at other loads are likewise better than the guarantees for the corresponding loads.

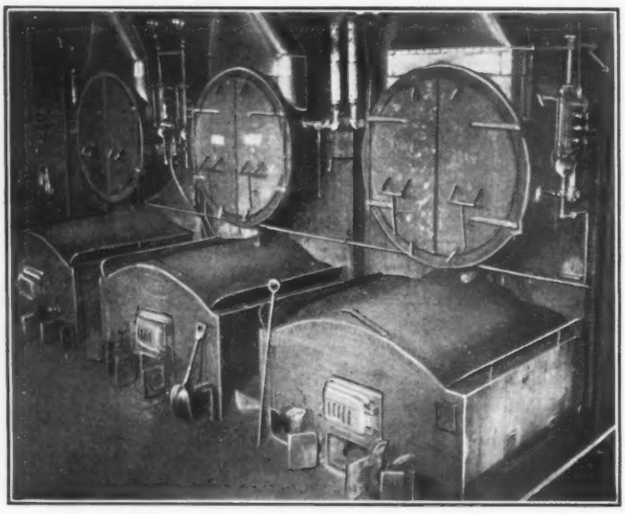


FIG. 7—RETURN-TUBULAR BOILERS AT HOOPESTON EQUIPPED WITH SEMI-AUTOMATIC DUTCH-OVEN FURNACES

The Hoopeston plant is operated non-condensing owing to the fact that no cheap water supply is available, the former plant having been operated on producer gas, and therefore required no extensive water supply. The present management, however, plans to install a cooling pond and spray system and operate condensing later on. Under present conditions the Hoopeston plant uses about 9 lb. of coal per kilowatt-hour.

ADVANTAGES OF FORCED DRAFT FOR PEAK LOADS

Flexibility of Operation, Readiness-to-Serve and Economy of Performance Incident to the Use of Forced Draft Make It Worth Consideration in Many Plants

The advantage of forced draft for driving boilers at the time of sudden demand is not realized to the extent that its merits warrant by many of the smaller central station companies. A number of these companies operate stations with load factors of 40 per cent and worse with a daily peak load of, perhaps, 25 per cent or more of the average maximum load. To care for this high demand, which usually lasts for but a short time each day, it is necessary to have boilers in readiness, which means banked fires, in proportion to the additional demand.

For example, if the daily peak load is 30 per cent above the average load then there must be 30 per cent more boilers available than would be required for normal average demand. These additional boilers may or may not be called into use according to circumstances, but they must nevertheless be held in readiness. Herein are to be found the advantages of using forced draft. It enables in many cases the installation of fewer boilers with the saving in their first cost and the cost of their housings, and in all instances enables fewer boilers to be kept in service with banked fires, resulting thereby in lower operating costs for fuel and labor.

Forced draft may be used for normal service, for regularly assisting over the daily peak-load period or for sudden heavy temporary loads such as sometimes occur in emergencies, summer thunderstorms, etc. In the latter cases, because of the intermittent and comparatively short length of time during which the mechanical draft is called into action, the minimum investment for equipment that will force the boilers to the desired capacity is of greater importance than high operating efficiency. For such classes of work steam blowers are usually indicated, whereas for continuous operation, where efficiency is important, power-driven fans are preferable. A power-driven fan can be operated with about 1 to 5 per cent of the total quantity of steam formed, whereas a steam jet will usually require from 10 to 25 per cent, hence the desirability of using power-driven apparatus for lengthy service is self-evident.

With forced draft used as here proposed there will be increased deterioration of the boilers and boiler settings as is to be expected, on account of the rapid change of temperature with sudden demand. Experience is showing, however, that this is much less than would at first be expected, and is more than offset by the saving in boiler investment, labor and fuel and improved operating conditions incident to the installation of forced draft. It is, of course, not necessary that blowers be installed under all boilers, but only under a sufficient number to bring the total boiler capacity up to the demands of the heaviest load. A boiler can, by forcing, be worked to about 200 or even 300 per cent of normal and in very short time. A judicious choice of equipment, so that each boiler is a unit in itself, will enable very satisfactory results to be obtained, while the cost of labor will be practically nil.

Besides the use of forced draft for helping over the peak-load periods and sudden demands that come unexpectedly, it will be found extremely useful in steam plants used merely as a stand-by for hydroelectric plants, where rapidity of getting up pressure irrespective of atmospheric conditions is of vital importance. A poorer grade of coal may be used with forced draft than with induced, and this may be turned to good account by the smaller company, in some cases.

Analysis of Merrill Report on Water-Power—II

Economic and Engineering Considerations Dictate Monopoly in Power Generation as Essential to Conservation and Although the Report Aims to Show Otherwise, the Evidence Is Lacking

LAST week's issue of the ELECTRICAL WORLD contained the first part of an analysis of the Merrill report on water-power and showed the document to be laden with error. As was previously pointed out, the burden of the report is to show that there is a marked tendency toward association or community of interests particularly between the principal holding companies. Consistency is not a virtue of the report, however, since while it preaches against monopoly in many sections, it shows in other sections that monopolization of the supply in any given territory makes possible through interconnections of stations and through diversification of loads, economies of operation that would not be possible for isolated independent stations.

Inasmuch as monopoly is usually associated in the public mind with things unlawful, and detrimental to society in general, it is interesting to note that monopolies in the electrical supply business do not fall within that category but on the contrary, are beneficial to society.

One of the water-power companies, singled out in the report for special attention for instance, is the Montana Power Company. This company has done much toward developing Montana, knowing that its welfare depends upon that of the State. In the brief résumé for each state taken from the water-power report and purporting to show the extent to which the movement toward concentration of control has progressed, it was stated that "four corporations control 97.4 per cent of the water-power and 91.8 per cent of the total power in the State of Montana. Two of these, the Montana Power Company and the Amalgamated Copper Company, affiliated concerns, control 94.4 per cent of the water-power and 88.7 per cent of the total power. Municipal plants have no water-power and but four-tenths of 1 per cent of the total power."

John D. Ryan, president of the Montana Power Company, at a hearing before the committee on public lands of the United States Senate, speaking of this monopoly said: "If there is a monopoly of power in the State of Montana, or in any other state, in my opinion, the public land states, it is only for one of two reasons: First, that the power cannot be developed under existing laws to advantage—power that has to be developed on government land; and second, that the money cannot be raised to develop it. If there is any monopoly, it is a monopoly of the market.

"My company, furnishing 85 per cent of the hydro-electric power made in the State of Montana, might be called a monopoly. But, if we have any monopoly, it is only a monopoly of the market. And, let me tell you that that monopoly was acquired in this way: When I took over these Great Falls powers, and looked into the question of developing a market for them, I found the mines of Butte and the smelters of Anaconda were using steam power. They had some electric power but not much. They were using steam power to the extent of about 35,000 hp. That was costing them an average of $85 a horsepower. * * * We made one contract for electric power to be delivered from our dam at Great Falls, 130 miles away, and took over all of that business on a contract for the life of the mines for $30 a horsepower-year. In other words, we saved on 35,000 hp. to that mining company in one swoop $55 a horsepower. If you can calculate that quickly in your mind you will see we enable that mining company to carry on its mining operations for $2,000,000 less money than it could have done without our power. * * * I want to call your attention to that contract. It is conservation; and the policy of conservation embodied in that contract refutes the statement made here in these hearings by one or two gentlemen (I do not remember just who they were) that the price of electric power is going to be regulated by the price of steam and that the electric power concern is simply going to take a shaving off the price of steam power in order to get the business. That is not the policy.

"There is an unlimited power where anybody can come and develop it if they can get the money to do so and find the market to use it. That has not been the case with us and I do not think it will be general. I believe that the development of the natural resources of the State which are going to result from these cheap powers are worth more than the saving that could be calculated on the present consumption of power in the State."

It might be interesting to note in this connection that there are very few steam plants in Montana and that the saving made possible to the mines in Butte and Anaconda by the substitution of electricity for steam has made almost like savings possible to the Butte, Anaconda & Pacific Railroad and the Chicago, Milwaukee & St. Paul Railway, which have electrified sections of their lines.

It would thus appear that the Montana Power Company created a market for its output, which while profitable to the company also proved a benefaction to the mining and railroad companies which it serves.

CONDITIONS GOVERNING HYDRAULIC DEVELOPMENT

In the attempt to show over-development in the State of California, the report itself makes an excellent plea for concentration of control. This, however, is what the report preaches against. Yet if maximum conservation is what is sought, the economics of engineering dictate concentration of control. The advantages of such control are recognized by government engineers who substantiate the contentions of other engineers conversant with water-power development. For instance, John C. Stevens, in writing on the water-powers of the Cascade Range in Water Supply Paper 253, says: "In the operation of power plants for public service, it is of prime importance that continuity of service be assured. The natural conditions of stream flow make it almost impossible for a single plant depending on water-power alone to insure continuous service. Hence, the necessity that one company should operate several plants.

"Requirements of power consumers are by no means uniform. They vary from hour to hour, from day to day and with the season. This non-uniform consumption requires that a certain reserve be maintained at all times to meet peak loads during the day and for regular and extraordinary demands that arise from time to time. Hence, even where one company operates several plants, it is virtually required to maintain auxiliary steam plants to be used in connection with the water-power plant.

"From the standpoint of the consumer also, whether an individual, a company or a municipality, there is every advantage of having the sources of power under one administration. Efficiency in operation and economy

in consumption, therefore, demand consolidation of interests. Such a consolidation which makes for conservative and efficient use of the natural power resources should not be prevented. The public concern, therefore, must be aimed not toward prevention of consolidation, but toward prevention of the harm to the public interests that might result from an unscrupulous administration of such a consolidation. The solution appears to lie in a wise legislative regulation of the manner in which power privileges shall be acquired and power plants maintained in order that the consumer shall be assured the necessary energy at a reasonable cost consistent with a just and reasonable income on the investment by the power company.

"The factors that govern power development are three: (1) The volume of water available; (2) the fall through which this water can be utilized; (3) the market for the power when developed.

"A project is feasible or not according as these factors are favorable. The market feature is, of course, independent of the other two and is subject to evolutionary laws. Therefore, in a public inquiry such as that covered by this report, it is necessary to consider only the physical features of discharge and fall, and to include all portions of the stream where such features make power development possible. Yet, a consistent regard must be had for practicability of development and some standard of comparison must be adopted.

"In developing power plants, it is profitable to install power units for a much larger amount of power than that represented by the minimum flow of the stream, for it is always necessary to have auxiliary steam plants which can be used to tide over a period of shortage of water and are called on for the peak loads. The interest, depreciation and maintenance charges of the steam plants must be carried in conjunction with the fixed charges on the water-power plant. Hence, the excess of power capacity which it is profitable to install over that afforded by the stream's extreme low water will depend on the relative cost of steam and water-power and on the peculiarities of the particular market served. This excess may vary from 50 to 300 per cent."

Control of Undeveloped Water-Powers

The report states that public service corporations "claim to own or control" at least 3,683,000 undeveloped water horsepower. This striking total, however, soon dwindles away on analysis. There are two kinds of control. First, absolute control which means ownership in fee to the exclusion of everyone else and the ability to resist the improvement of sites even when their product is demanded by the public. Such control is in these days of public service regulation exceedingly rare, and is in fact non-existent in the regions principally discussed in the report. There is, second, a so-called control of water-power sites which is so greatly qualified as really to amount to no control at all.

For instance, four large water-power companies in the West in their annual reports and circulars claim to control undeveloped water-power sites to the aggregate of 1,262,000 hp.

However, the land constituting the power sites entering into this aggregate is only partially owned by these companies. In some cases they own very little. In other cases it consists only of the ownership of water rights under state laws, the fee and all the other rights being in government ownership. One Western power company claims to own 550,000 of the undeveloped horsepower along one river. This control consists of a comparatively small amount of land and certain water rights. Most of the land comprising these sites is in the ownership of the federal government and cannot be utilized except on such terms and under such restrictions as the government wishes to impose. The fact that the company owns certain land and certain water rights will be of advantage to it only when the government conveys the land either temporarily or permanently under the laws of the United States. On a navigable stream in the Middle West a company owns land on which it bases the claim of control of upwards of 100,000 hp. But, before that company can lay a stone in the development of these sites, it must secure a permit from citizens, develop under plans approved by the Secretary of War and concede the paramount interests of navigation.

Another company in a Southern state owns all the land necessary to the development of 70,000 hp. along a navigable stream. That company wishes to develop, in fact it had a market provided for the energy and endeavored to secure legislation under the general dam act but failed to do so on account of the Presidential veto. Consequently, that company with all its ownership and control has been unable to lift a hand in the development of its power site even to the present day. Such control is no control at all and in most cases undevelopment is due not to the owners of a site but to the failure of the laws.

Confusion About Earnings

In discussing the report with a New York banker engaged in financing public utility properties he said: "I have not studied the Merrill report; I do not suppose anyone will except to confirm his own previously formed ideas on the subject of water-power. I suppose it is entirely beside the subject to suggest that if the federal government would spend a little time tending to its own proper business—namely, the formation of a proper army and navy—our all-wise officials in Washington would not have so much time to devote to telling business men how to run their business.

"I am familiar with the electric power business from the standpoint of engineering and banking—that is, from the standpoint of construction, operation and financing. As I turn the pages of Part II of the Merrill report I am struck with the vast amount of labor and expense involved in collecting all of this absolutely useless information—that is, except possibly for political purposes. From the practical standpoint of an engineer or banker I shall relegate this report to the files and probably never look at it again."

Quoting from the Census Report of 1912 Mr. Merrill states that the dividends on common stock of commercial stations were 2.5 per cent and on preferred stock, 3.4 per cent. He asserts, however, that dividends paid are different from dividends earned and that the latter are much greater. He declares that if the various commercial companies had distributed all their surplus to stockholders, the dividends upon stock would have been 5.79 per cent. The Census of 1912 on which Mr. Merrill bases his discussion shows the following in respect to commercial central stations:

Total cost of properties	$2,098,613,122
Gross income	278,896,610
Expenses	169,117,097
Net income	109,779,513
Interest on funded and floating debt and sinking fund	48,385,216
Gross surplus	61,394,297
Stock dividends	34,580,872
Net surplus	26,773,425

The net profits of any enterpise consist only of the money which may safely be withdrawn from the business. That which may not be safely withdrawn can never be accounted as profit. In appraising the success of the electric business, therefore, or any other business, it is manifestly out of the question to figure into funds available for dividends those assets, the withdrawal of which would render the business unsafe. Dividends are, or should be, a measure of prosperity and never a raid on working capital.

Papers and Discussions of A. I. E. E. Annual Meeting

Abstracts of Papers and of Discussions Presented on Industrial Power, Power Transmission, Protective Apparatus, Electro Physics and Special Technical Subjects

THE general features of the thirty-third convention of the American Institute of Electrical Engineers, held in Cleveland, Ohio, from June 27 to 30, were presented in last week's issue of the ELECTRICAL WORLD. The meeting was one of the largest held during a number of years, the total registration of members and guests being around 600. The program was well arranged and the papers presented were of a nature to bring out a great deal of interesting and practical experience in their discussion. In what follows brief abstracts of these papers are presented, together with the chief points brought out in discussions.

Power Transmission

REPORT OF TRANSMISSION COMMITTEE

The report of the transmission committee, of which Percy H. Thomas was chairman, contained opinions of central station men regarding the effect of altitude on the operating temperature rise of electrical apparatus and pertaining to the value of grounded neutrals on high-tension transmission lines. Thirty-one replies were received on the first-mentioned subject. Of these fifteen were from plants operating apparatus at 5000 ft. altitude or higher. Six of these make no correction for altitude and six have noticed no effect of altitude.

The replies from operating companies on the value of grounding neutrals emphasized that the effect of grounding the neutral of a high-tension system will vary under different conditions. Furthermore, the effect of grounding through a resistance is different from the effects of grounding directly. When the ground is specifically omitted it is usually to enable operation with one line grounded and thus minimize interruptions.

Discussion

The report of the transmission committee was read in abstract by N. A. Carle. Each of the two sections was discussed separately, the first part by M. O. Troy, Schenectady, N. Y., and the second part by the following: Peter Junkersfeld, Chicago, Ill.; E. E. F. Creighton, Schenectady, N. Y.; D. B. Rushmore, Schenectady, N. Y.; N. A. Carle, Newark, N. J.; J. T. Lawson, Newark, N. J.; J. B. Taylor, New York City; P. H. Chase, Newark, N. J.; H. R. Woodrow, New York City; E. C. Stone, F. L. Hunt, Greenfield, Mass.; L. N. Crichton, East Pittsburgh, Pa.; R. F. Schuchardt, Chicago, Ill.; E. T. Street, St. Paul, Minn.; Harold Goodwin, Philadelphia, Pa., and W. A. Carter, Denver, Col.

In reference to the data collected and opinions on effect of altitude on temperature rise of electrical machinery, Mr. Troy pointed out that the correction is one of small magnitude and that the data secured are not accurate enough to draw conclusions.

In a written discussion on the second part of the committee's report presenting experience with the grounded neutral on high-tension transmission lines, Mr. Junkersfeld outlined the practice of the Commonwealth Edison Company. He reviewed the conditions under which the neutral was grounded fifteen years ago and present-day practice. The experience covered the operation of a four-wire, three-phase, 2300/4000-volt, 60-cycle system of primary distribution and a 25-cycle, 9000-volt system. The benefits, in brief, as outlined were prompt automatic disconnection of faulty feeders, assistance in locating line breakdowns and the prevention of arcing grounds.

Professor Creighton brought out the point that there are cases where the neutral can be judiciously grounded and other cases where it is better not to ground if proper precautions are taken. The greatest objection to a non-grounded neutral is the arcing ground. When a system is thoroughly protected against high frequencies by proper absorbing devices, he considers that it becomes permissible to use an ungrounded neutral.

Mr. Lawson stated that the action of relays with the grounded system may be somewhat more satisfactory, but with the single-phase arc to ground relay protection is not necessary if the arc is extinguished before it has a chance to develop into a short-circuit. The operation of the ungrounded system by the Public Service Corporation of New Jersey and use of the arcing ground suppressors warrants this opinion.

Mr. Woodrow stated that on the 60-cycle system of the New York Edison Company, the grounded neutral has been in operation more than two years, and so far as service is concerned little difference is noted on the 60-cycle system before grounding and after grounding. The 25-cycle system has never been grounded and no high-frequency disturbances have been experienced.

Mr. Stone outlined conditions on a 11,000-volt, three-phase, 175-mile transmission system of which about 50 miles is underground. A great deal of trouble is experienced from arcing ground originating in the overhead system, which set up voltage disturbances and break down the cable system. It has been decided to use a grounded neutral in an attempt to save the cable and maintain continuous service on the overhead system.

Messrs. Hunt, Crichton and Street outlined cases where lines have been operated a short time with one wire grounded on an ungrounded system.

EFFECT OF BAROMETRIC PRESSURE ON TEMPERATURE RISE OF SELF-COOLED STATIONARY INDUCTION APPARATUS

The principal laws of dissipation of heat were reviewed, a formula for the effect of altitude on cooling of surfaces was developed and methods of conducting experimental observations on radiation were discussed in a paper by V. M. Montsinger. It was shown that the percentage increase in temperature equals $AS\ (5 + a)$, in which A is the increase in altitude in kilometers, S is the shape factor or the developed surface $\div$ (developed surface $+$ 1.3 e envelope surface) and a is the ratio of the copper loss to the total.

This paper was briefly discussed by J. M. Wood, Pittsfield, Mass.; Prof. R. W. Sorensen, Pasadena, Cal., and Prof. A. M. Gray, Ithaca, N. Y.

RESTORATION OF SERVICE AFTER NECESSARY INTERRUPTION

Methods of minimizing the duration of unavoidable interruptions were outlined in a paper presented by F. E. Ricketts. It was pointed out that since the amount of service affected by opening a switch is usually in proportion to the nearness of the switch to the generator, the importance of keeping switches closed should increase as the generators are approached. Therefore generator switches should never open automatically on overload.

To prevent internal trouble in the generators causing serious disturbances, which would happen with this arrangement, the author suggested a method of connecting relays which will de-energize the field and isolate the generators if any internal troubles arise. Another scheme was described for extinguishing short-circuit arcs by interrupting the generator field current and then restoring it before motor-driven apparatus on the line has stopped. Arrangements were described for raising the voltage rapidly on restoring service so that all apparatus would pull into step quickly. Numerous records were presented showing the effectiveness of several schemes for minimizing interruptions.

Discussion

This paper was discussed by Harold Goodwin, Jr., Philadelphia, Pa.; R. J. Schuchardt, Chicago, Ill.; H. R. Woodrow, New York City; E. T. Street, St. Paul, Minn.; G. A. Burnham, Cliftondale, Mass.; J. B. Taylor, New York City; L. N. Crichton, East Pittsburgh, Pa., and J. T. Kelly, Jr., Baltimore, Md.

Mr. Goodwin brought up the point in connection with the systems described by Mr. Ricketts, that disturbances on a distribution system might be caused by the starting of motors which were not equipped with relays, but which were heavily fused. He also mentioned possible trouble resulting from the operation of a three-phase motor with one of the phases dead. He recommended that some scheme for operating hand-operated switches as well as electrically operated switches be devised for the restoration of the service immediately similar to the scheme outlined in a diagram of the paper.

Mr. Woodrow explained a practice used by his company with hand-operated switches. The switches are thrown in once or twice after the circuits have been through a lightning storm, and in 50 per cent of the cases the service is restored without any disturbances. Other speakers commented on the operating features described in the paper.

Protective Apparatus

Lightning Protection on 4000-volt Circuits

From investigations made on the Chicago electric service system reaching 250,000 customers over about 3000 miles of circuit and through 16,000 transformers, D. W. Roper has arrived at the following conclusions regarding transformer protection. Transformer troubles caused by lightning storms may be reduced (*a*) by removing the transformer primary terminal boards, and (*b*) by installing lightning arresters. The latter are considerably more effective if installed on transformer poles.

Protective Apparatus Used by New Jersey Company

On the New Jersey system the total number of service interruptions due to line and cable trouble has been considerably decreased since 1913 despite the increase in mileage. N. L. Pollard and J. T. Lawson explained in a paper how this has been accomplished by eliminating all defective equipment and using a number of protective devices and connection schemes. The nature and operation of these devices was described.

Protection of High-Voltage Distribution Systems by Isolating Transformers

To prevent widely-separated grounds on different phases affecting its entire system the Public Service Company of Northern Illinois has installed line sectionalizing or isolating transformers at its substations and generating stations, as well as at several points on the transmission system. In some cases, O. O. Rider explained in his paper, 1-to-1 transformers have been used, and in other cases two banks of standard step-down transformers have been arranged so the high-tension windings are connected with the sectionalized lines and the low-tension windings connected in parallel. The latter arrangement has been employed chiefly at distribution or feed-in points to furnish low-voltage tap.

Discussion

The discussion on the six papers presented by members of the protective apparatus committee was opened by Prof. E. E. F. Creighton, chairman of this committee. He stated that during the past year the individual members of the committee had done a great deal of work, as evidenced by the papers presented. In addition to this work, Professor Creighton referred to valuable data furnished by Harry R. Woodrow of the New York Edison Company, to results of an investigation on protection of telephone lines situated under power lines by E. P. Peck of the Georgia Railway & Power Company, to an investigation with a new type of relay by Archbold Davis. The work of E. B. Merriam of the General Electric Company and S. Q. Hays of the Westinghouse Electric & Manufacturing Company on rating of oil switches was also mentioned.

The paper by D. W. Roper, the one by Messrs. Pollard and Lawson and O. O. Rider's paper were discussed together. The following took part in the discussion: Dr. C. P. Steinmetz, Schenectady, N. Y.; P. H. Chase, Newark, N. J.; J. P. Lawson, Newark, N. J.; J. B. Taylor, New York City; J. O. Montignani, Rochester, N. Y.; R. F. Schuchardt, Chicago, Ill.; Peter Junkersfeld, Chicago, Ill.; D. B. Rushmore, Schenectady, N. Y., N. S. Diamant, Houston, Tex.; and N. L. Pollard, Newark, N. J.

Dr. Steinmetz considered one conclusion from Mr. Roper's paper interesting and significant, namely, that 100 per cent protection is not warranted by mere cheapness, but that the cost of 100 per cent protection is somewhat greater than the cost of repairing damaged transformers. In this connection he referred to the significant statement that in spite of this fact 100 per cent protection will be introduced in Chicago because of the reliability obtained. In closing, Dr. Steinmetz referred to the possibility of overcoming apparently abnormal operating conditions by eliminating carelessness. He said that the fallibility of human nature is a very frequent cause of trouble which can only be remedied by automatic devices which are not careless and do not forget to record undesirable incidents.

Mr. Chase abstracted a written discussion in which he explained points in connection with methods which involve the use of the split or divided conductor principle in relay control of transmission circuits.

Mr. Montignani referred to operating conditions in Rochester, N. Y., in connection with a three-phase, four-wire, 4150-volt, grounded neutral distribution system, having a total length of about 1200 miles, 300 miles of which is underground. Previous to 1911, reliance for protection against lightning was placed upon multi-gap arresters placed approximately at 0.5-mile intervals on the more exposed lines. This proved inadequate, and during the summer of 1911 systematic records were compiled of lightning troubles. These records showed that ninety-nine transformers were lost in thirty-one thunderstorms, this being 6.1 per cent of the total transformers installed. The multi-gap arresters were removed from the lines and outdoor-type electrolytic arresters were installed at exposed parts of the system and at important junction points on the feeders. With this equipment, records for the summer of 1912 showed lost transformers reduced to 1.2 per cent after thirty-two thunderstorms. The estimated saving in reduction of transformer damages from 6.1 per cent to 1.5 per

cent and estimated current sales amounted to a little more than $2,000, after allowing for interest, depreciation and maintenance of the arresters.

Mr. Junkersfeld offered a word of caution against over-standardization. He stated that the development and investigation in Chicago referred to in Mr. Roper's paper cost many thousands of dollars, but was considered justifiable for the reason that it would do more toward improving service than if spent in any other direction. The conditions under which service is rendered, he stated, determines the amount of refinement that good engineering will justify in any case. He also emphasized the value of education and discipline in preventing accidents. In Chicago a very strenuous campaign of education has been inaugurated with the result that accidents have been practically eliminated.

In closing the discussion, Mr. Roper pointed out that the neutral wire is not used in Chicago for overhead lightning protection since protection is used at the substation. At each transformer where a fuse arrester is installed, an arrester is also installed in the neutral wire. A ground rod is used for the ground connection. He stated, that excluding burnouts due to external forces, such as a pick driven into a cable, the faults in the 9000-volt cable system averages from two to four per hundred miles per year. This data supplements a point brought up by Mr. Taylor.

MEGGER AND OTHER TESTS ON SUSPENSION INSULATORS

Results of megger tests on 4410 disk insulators, costs of makingv the tests and replacing the insulators and tests on faulty units were given in a paper by F. L. Hunt. Of the damaged strain units located, the highest percentage were situated at the line end of the strings. On the standard suspension towers, on the other hand, the greater number were next to the cross-arm. Although the occurrence of faulty insulators decreased from the line end of the string to the cross-arm unit on strain towers, there appeared no logical relation between the number of failures on the suspension string.

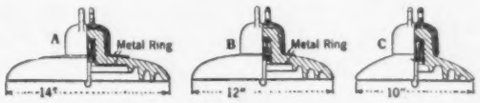
The tests were conducted by a three-man crew, and the average cost of labor was $1.70 per tower per circuit, or 9.6 cents per insulator tested, although another section was tested at an expense of 7.3 cents per insulator. Replacing the bad insulators cost 7.3 cents per insulator on the line, making the total cost of testing and replacing insulators 16.9 cents per insulator on the line, or $1.73 per faulty unit.

EXPERIENCES IN TESTING PORCELAIN

Porosity, absorption, surface leakage and dielectric losses of porcelain were subjects touched on in the paper by E. E. F. Creighton. Wet-process porcelains, it was pointed out, have porosities much less than 0.01 per cent, whereas dry-process porcelains usually have 1 to 2 per cent porosity. While insulators with small porosity may not absorb much water when submerged in a bath, they will absorb considerable under operating conditions because changes in temperature causes a breathing action in the pores. Considerable energy is sometimes required to drive moisture out of insulators. As a rough method of analysis, it may be assumed that an insulator is porous which measures less than 600 megohms and withstands nearly flashover voltage for several seconds. The surface resistance of a porcelain insulator, according to tests, decreases rapidly with increase in humidity (2000 megohms at 60 per cent humidity and zero megohms at 80 per cent humidity), but in service the leakage of current may produce sufficient heat to prevent the resistance dropping to very low values. Increasing the size of an insulator does not necessarily increase its resistance, small insulators in many cases having higher resistance than larger ones.

NEW METHOD OF GRADING SUSPENSION INSULATORS

To correct the uneven distribution of voltage over long strings of disk insulators, R. H. Marvin suggested placing sheet-metal rings of different size around each insulator cap and stud. To maintain equal flashover strengths over each unit those with the larger corrective rings should have the larger diameters. As this would entail difficulties in manufacturing and assembling, the author suggests using only three groups of units and assembling them so that the diameter de-



INSULATOR UNITS EQUIPPED WITH METAL RINGS TO IMPROVE VOLTAGE DISTRIBUTION

creases toward the grounded support. A needle-gap for ascertaining the voltage distribution over a string of insulators was described, and results of tests obtained therewith were presented. The latter showed that grading the insulators in the manner mentioned improves the distribution considerably. For instance, compared to the line unit the efficiency of the lowest unit tested was raised from 23.5 per cent to 46.5 per cent, or nearly doubled. This resulted in reducing the proportion of the total voltage on the line unit from 16.5 per cent to 11 per cent, a reduction of 27 per cent. The theory of grading insulators was also discussed.

Discussion

The paper entitled "Megger and Other Tests on Suspension Insulators," one on "Experiences in Testing Porcelain Insulators," and the paper entitled, "New Method of Grading Suspension Insulators" were discussed together. Those who took part in this discussion were: F. W. Peek, Jr., Schenectady, N. Y.; and Prof. E. E. F. Creighton, Schenectady, N. Y. Mr. Peek offered a word of warning on the danger of misinterpreting test data, especially in regard to insulation testing. He referred to testing insulators with high frequency and pointed out that many good insulators as well as the poor ones are often discarded based on results of this test. He mentioned the importance of a test that would anticipate failure of insulators on lines due to deterioration, and explained that so-called deterioration of porcelain is due to two causes: First, low breakdown strength due to the gradual absorption of moisture after the insulators have been in service several years. There is no high voltage test that will detect this condition of the porcelain. Second, poor mechanical design or mechanical strain; in each of these cases, no high-voltage tests will anticipate failures. Mr. Peek expressed the opinion that a great deal can be done to predict possible failures, due to design, to the cement, to absorption, and the like, by making a proper absorption test and a proper mechanical design test—for instance, by expansion and contraction, by heating and cooling.

Professor Creighton agreed with Mr. Peek that there is no electrical test known that will eliminate all defective porcelain. He stated, however, that where the high-frequency test is used at the factory when the porcelains come directly from the furnace, on the average 8 per cent more porcelain is eliminated than on the 60-cycle test. Professor Creighton explained that as a result of comparisons between the two tests, the 60-cycle test and the high-frequency test, the former has been replaced by the latter in work at the factory of the General Electric Company, although it may be found expedient to apply both the 60-cycle and the high-frequency test to the finished insulators.

Industrial Applications

Electric Drive for Reversing Rolling Mills

Comparisons of results obtained with electrically-driven and steam-driven reversing rolling mills were made in a paper presented by Wilfred Sykes and David Hall, and attention was called to some of the engineering requirements which should be considered in this service. In discussing the general characteristics of rolling mill loads it was pointed out that compound motors are best adapted to the service since with excessive loads they will slow down and develop more torque.

UNIT ENERGY CONSUMPTIONS FOR ROLLING STEEL IN REVERSING MILLS

Ingot	Bloom	Elongation	Hp-hr. per Ton	Remarks
18 in. round	7⅜ by 7⅜ in.	4.66	11.4	High carbon
18 by 20 in.	3 by 8 in.	12.2	23.0	High carbon
18 by 20 in.	2 by 16 in.	9.2	19.4	Soft steel
18 by 20 in.	4 by 4 in.	18.5	26.0	.....
17 by 15 in.	4 by 4 in.	16.0	24.0	.....
20 by 20 in.	5 by 5 in.	16.0	25.5	.....
20 by 20 in.	8 by 8 in.	6.25	17.0	.....

However, owing to the large currents usually required, reversing the operations have necessitated energizing the series fields from separate series exciters instead of with armature current. Data were presented to show that the initial investment required for motor drive with purchased power is considerably less than for steam equipment, while that for electric drive with private plant generating equipment is certainly not much different. Regarding energy consumption it was shown that, even when generating the electric power used, motor drive requires only 50 to 60 per cent of the energy used by the best steam reversing engines. Furthermore, the energy required for retarding the motor prior to reversal may be stored in the flywheel and utilized to carry the subsequent peak load.

Discussion

Among those taking part in the discussion of the steel-mill electrification paper were K. A. Pauly, Schenectady; N. Y.; D. M. Petty, Bethlehem (Pa.) Steel Company; R. Tschentscher, Illinois Steel Company, Chicago; T. E. Tynes, Lackawanna Steel Company, Buffalo, N. Y.; H. D. James, Pittsburgh, Pa.; E. A. Lof, Schenectady, N. Y.; F. G. Liljenroth, Vestaras, Sweden; Brent Wiley, Pittsburgh, Pa., and H. S. Page.

The torque rating of motors for steel-mill work was objected to by Mr. Pauly as unsatisfactory unless the time during which the maximum load is carried be considered. He also held that the rating was not in accord with A. I. E. E. standardization rules. In referring to the economy effected by motor drive in reversing mill work, he pointed out that the doing away with wasteful reversing engines was not the only saving, for the efficiency of the boiler plant can also be raised as much as 20 per cent by taking off the large demands for steam required by the reversing engines. He explained the design features of rolling-mill motors and hoist motors, showing how both are similar in respect to handling shocks. Mr. Pauly maintained that compounding action is not necessary to secure rapid acceleration, and explained the value of breaking spindles.

Mr. Petty mentioned the manufacturing advantages made possible by motor drives in steel-mill work, such as reducing the distance that steel is required to travel from soaking pit to finished product and general flexibility of plant layout. He referred to commutator and brushes as sources of most motor troubles, and advocated more liberal design and lower speeds in order to reduce operating and maintenance costs.

Mr. Tschentscher said that the reversing mill installed at South Chicago in 1905 was in operation before the installation at Gary, Ind. He called particular attention to the mechanical design features of motor drives, and showed that to the steel-mill engineer liberal bearings and design of parts to stand wear and tear are important considerations. High reliability, this speaker held, is more important than securing the last hair in efficiency. He also said that rapid reversal is not important, a reversal in five seconds being average practice.

Mr. Lof abstracted in brief a written discussion by E. G. Liljenroth, which compared steel-mill practice in this country with that in Europe. Speeds of foreign installations are much higher than now used in this country. One foreign manufacturer makes a line of motors all of the same diameter, the variation in size being in the length of the armature. Units of large size are being used abroad, and have speeds around 500 r.p.m. with special flywheels.

Mr. Wiley said that there are 300 electrified steel mills and eighteen reversing mills. Thirteen of the reversing mills have been installed or electrified during the past year and a half. Mr. Page brought out the fact that the speed of reversal depends upon the speed of the mill. He also explained the rating of motors in torque and horsepower at different speeds.

In closing the discussion on the paper Wilfred Sykes explained that peak load and not heating controls the rating of the motor, and that the problem of commutation mentioned by Mr. Petty was more important than the heating.

Requirements of Motors Used for Oil-Well Operations

Methods of adapting motor drive to drilling, pumping and cleaning oil wells and an outline of the duty cycles of each operation were given in a paper presented by W. G. Taylor. The heaviest work required of a drilling motor is the manipulation or "spudding in" of a well casing. Other drilling operations are light work. The total energy consumption during drilling increases approximately as the square of the depth. When no accidents occur, the average daily energy consumption is about 230 kw.-hr. Fifty to 75-hp. slip-ring induction motors with secondary control are usually the best for drilling.

The amount of power required to pump a well does not seem to depend on its depth, the author pointed out, since presence of sand in the oil may increase the power required while gas tending to lift the oil will have the reverse effect. According to records from over 200 California oil wells pumped "on the beam" about 1 to 5 hp. were required.

Pulling rods and tubing is ordinary hoisting work and requires a high-torque motor with low-armature inertia. Of the various operations of cleaning a well swabbing demands the most power, peak inputs which have been recorded being as high as 40 to 70 kw. The total monthly energy consumption for pumping, pulling and cleaning a well will vary from 1350 to 6000 kw.-hr., but the average is about 2100 kw.-hr. Where a single motor is desired to perform all these operations Y-delta or two-speed motors are advisable.

Discussion

Due to lack of time this paper was only briefly discussed by Edward Woodbury, Pacific Light & Power Corporation, Los Angeles, Cal., and A. M. Dudley, Pittsburgh, Pa. Mr. Woodbury explained the difficulties in introducing electric pumping in the Los Angeles dis-

trict because of the prejudice of the operators and their desire to injure the motors through severe treatment. Little damage to motors, however, has been experienced. The greatest saving, according to Mr. Woodbury, through the use of motors in oil well work, is the cleaning and pumping operations. He mentioned one large installation which operated thirty-five to forty wells over an area of 100 acres, using gas and oil as fuel. By equipping twenty wells with motors no oil was required and the gas consumption was considerably reduced. He maintained that in his section oil-well operators can afford to throw away engines and pay for motors from the savings effected by their use. Mr. Dudley referred to the diagram by the authors for a standard oil-well drilling rig using a walking beam, from the end of which a heavy stem and bit are suspended by a suitable rope, as good practice. This is known as the cable-tool method as compared with the hydraulic rotary method. He favored the use of the induction motor for this work.

Electrophysics

EFFECT OF HIGH CONTINUOUS VOLTAGES ON AIR, OIL AND SOLID INSULATIONS

Results of tests on the dielectric strengths of air, oil and solid insulations for direct-current voltages up to 150 kv. were given in a paper by F. W. Peek, Jr., and the conclusion was drawn that high-voltage, direct-current testing equipment is suitable for locating faults in cables, and is less bulky to handle than the alternating-current type. Most of the results indicated that the formulas already given for a.c. corona may be used for d.c. corona over a wide range of wire diameters, air densities, etc.

Discussion

The paper by Mr. Peek on the testing of insulations with high, direct-current voltages was discussed by Dr. J. B. Whitehead, Baltimore, Md.; William Baum, Schenectady, N. Y.; S. Farwell, Springfield, Ill.; C. E. Skinner, Pittsburgh, Pa.; Dr. C. H. Sharp, New York City, and J. B. Taylor, New York City. Mr. Baum pointed out that a direct-current test voltage two and a half times greater than an alternating-current test voltage produced the same results as the lower alternating-current value. He also mentioned that less insulation is required for direct-current cables than for alternating-current cables of the same size and voltage rating. Mr. Skinner pointed out the advantage of predetermining the breakdown point of cables and the possibility of establishing a method whereby this point can be determined from the performance before rather than after the actual failure of a cable. Mr. Farwell outlined tests with high, direct-current voltages performed some time ago at the University of Illinois. In closing the discussion Mr. Peek said that reference was made by him to the possibilities of picking out faults in cables with direct current, but he does not recommend its general use until further investigation has been made. He mentioned the advantage of burning out faults in cables so that they can be located by bridge methods. He also explained that a direct-current set for testing cables is more practicable than an alternating-current test set for the reason that it is much more convenient to transport and easier to handle.

CORONA VOLTMETER AS A STANDARD INSTRUMENT*

An instrument in which the first appearance of corona is used to measure voltage was described in a paper by J. B. Whitehead and M. W. Pullen. To detect the first occurrence of the corona three methods are employed which involve the use of an electroscope, galvanometer and telephone respectively. In brief, the apparatus consists of two concentric cylinders inclosed in an airtight compartment in which the air pressure can be varied at will. To measure an unknown voltage it is applied across the gap between the cylinders and the air pressure gradually lowered until corona appears. From a curve indicating the relation between air density and voltage at which corona appears the latter can then be determined. No spark-over, arc, energy consumption, series resistances nor condensers are necessary in the operation, and the readings are independent of wave form, frequency and local electrostatic disturbances.

Discussion

This paper was discussed by L. W. Chubb, Pittsburgh, Pa.; Dr. C. H. Sharp, New York City; J. R. Craighead, Schenectady, N. Y.; Prof. C. F. Harding, Lafayette, Ind.; F. W. Peek, Jr., Schenectady, N. Y., and Professor Kuntz, Urbana, Ill. Mr. Chubb expressed the opinion that the Whitehead corona voltmeter should displace the sphere gap as a working standard for the reason that it is free from the errors of the former. He mentioned many ways by which its accuracy might be checked. Other speakers asked questions concerning features of operation not explained in the paper. Mr. Peek explained the use of the sphere gap for investigating transients of the order of 0.00001 second such as lightning phenomena. He maintained that the sphere gap is most applicable for this work on account of its convenience. Professor Kutz explained the possibility of observing corona in the Whitehead corona voltmeter by the increase of pressure when corona forms. He mentioned investigations of corona in hydrogen gas at the University of Illinois. He has found that positive corona is uniform, while negative corona appears as beads and that the constants for the two are different.

In closing the discussion Dr. Whitehead answered the questions brought up. He explained that it is possible to make the corona voltmeter a good working standard as there are no practical difficulties in its operation and it repeats results with accuracy. He has found no variation in results secured due to variation of ionization of the air in the voltmeter chamber. Temperature changes due to varying the air pressure in the chamber have no effect on the operation of the instrument owing to the large volume of air used and the small range of pressure. Dr. Whitehead explained that he has found it possible to produce continuous negative corona without beads when the circuit conditions are held constant.

THEORY OF PARALLEL GROUNDED WIRES AND PRODUCTION OF HIGH FREQUENCIES IN TRANSMISSION LINES

Mathematical analyses were made in a paper by E. E. F. Creighton to determine the advantages or disadvantages of using overhead grounded wires. Conditions of line construction that cause and suppress high-frequency surges were also discussed. The general deductions for practical use taken from the theory given are as follows: From a theoretical standpoint a single grounded wire should be placed as near as practicable to the power wire in order to get the greatest electrostatic protection. Grounded wires are a little more effective when placed above a power wire than when placed below it. The greatest advantage can be obtained by keeping the overhead grounded wires as far apart as possible, that is to say, installed, as far as practicable on opposite sides of the power wires. The protective value of the second wire will then have its full maximum possible value.

*A detailed description of this equipment and method of using it was given on page 1405 of the July 17 issue of the ELECTRICAL WORLD.

Also from the electromagnetic standpoint, the two wires should be placed, so far as practicable, on opposite sides of a power wire in order to reduce to a minimum the transfer of surge energy to the power wire. The most practicable condition of protection by grounded wires is to use the four wires in a rectangular formation which gives the widest separation.

Discussion

For lack of time Professor Creighton's paper was only briefly discussed by H. S. Osborne, New York City; J. B. Taylor, New York City; Dr. J. B. Whitehead, Baltimore, Md., and L. W. Chubb, Pittsburgh, Pa. Mr. Osborne showed that for the proper operation of a ground wire the condition of the ground and the effect of the resistance are important considerations. Mr. Taylor criticised the use of the terms sudden and instant in the paper, and questioned the explanation of the release of charge on the ground wire when same is free to ground over a line one mile long. He emphasized the need of good ground wire construction for satisfactory operation. The other speakers questioned some of the assumptions in the paper, but in general agreed with the theory outlined. In closing this discussion Professor Creighton made it plain that the paper was based on certain assumptions, for there is little practical data on which to base definite laws due to the nature of the phenomena discussed. He agreed that certain assumptions might be questioned, but stated that the importance of discussing the various features in their simplest form had justified such assumptions. He maintained that increased protection can be secured for transmission line circuits by the use of a larger number of ground wires than are employed at present.

Electrical Research

Suggestions for Electrical Research

A list of electrical topics suitable for theses, research and advanced study was presented in a paper by V. Karapetoff. The author urged colleges to specialize in only a few topics for advanced investigation each year and warned against duplication of effort. He suggested that the educational committee of the A.I.E.E. become a central body for the dissemination of information and to provide a stimulus in applied electrical research, co-operating with colleges and with individual inventors and investigators.

Discussion

Professor Karapetoff's paper was read by Prof. A. M. Gray and discussed by Dr. J. B. Whitehead, Baltimore, Md.; Prof. A. E. Flowers, Columbus, Ohio; C. E. Skinner, Pittsburgh, Pa.; Prof. F. C. Caldwell, Columbus, Ohio; Prof. E. E. F. Creighton, Schenectady, N. Y.; Prof. D. D. Ewing, Lafayette, Ind.; Prof. C. F. Harding, Lafayette, Ind; J. J. Carty, New York City, and D. H. Braymer, New York City.

The main points brought up in this discussion dealt with practical ways of encouraging research work in colleges and securing the greatest benefit from such work both as a definite university activity and as a training for students who possess qualifications for research. While there was a feeling that there is little compensation for research work and little incentive from this standpoint to take up the work in college, it was considered by a number of the speakers that the results of research are its reward, and that it is impracticable to offer prizes or otherwise induce students except to direct ability and furnish facilities. It was brought out that there is a serious lack of original work of real merit that can be credited to American universities during the past few years. One speaker deplored the tendency of universities to conduct commercial investigations when it is their business to teach, train in fundamentals and direct research ability. Another speaker expressed the opinion that the best way to develop research and inventive genius was to secure men who have an idea to do something and some idea of doing it, then set them loose in a junk house with instruments and facilities and let them work. This plan, it was said, has worked out very well at Leland Stanford University.

Tractive Resistance of Different Roads to Vehicles at Different Speeds

A complete report of an investigation on tractive resistances of urban roads to a motor delivery wagon equipped with solid rubber tires was given in a paper by A. E. Kennelly and O. R. Shurig. The investigation involved test runs to determine the gross battery output, and laboratory tests to determine the over-all efficiency of the truck. The over-all efficiency reached a maximum of 28 per cent under favorable conditions and the mechanical efficiency was found to be as high as 90 per cent. Expressed in the equivalent per cent grade, the displacement resistance varied from 0.85 per cent for hard, smooth asphalt or bituminous concrete to 1.6 per cent for soft tar macadam and was constant for all speeds.

The impact resistance, according to test, increased with velocity, total weight of vehicle and road roughness. Air resistance on the vehicle tested was, roughly, 0.11 per cent equivalent grade. In order of desirability for vehicle operation road materials rank as follows: 1, asphalt; 2, wood block; 3, hard, smooth, macadam; 4, brick block; 5, granite block with cement-filled joints; 6, cinder; 7, gravel, and 8, granite with sand-filled joints.

Application of Polar Form of Complex Quantity to Calculation of A.C. Phenomena.

A simple method of dealing with vector quantities directly instead of with their rectangular components was described by N. S. Diamant, who discussed briefly the use of a polar form of complex quantity. It involves the use of the operator j^n where, contrary to ordinary usage n may be a positive or negative fraction. The operator follows the rules of algebra. To illustrate its use a few problems were worked out. A summary of formulas was also given.

Discussion

This paper was discussed by Prof. A. M. Gray, Ithaca, N. Y.; Prof. J. B. Whitehead, Baltimore, Md.; Prof. E. E. F. Creighton, Schenectady, N. Y., and E. H. Colpitts, New York City. The discussion resolved itself into a debate over the value of mathematics in practical work rather than a consideration of the merits of the paper. The opinion of the majority was that although mathematics is not used by the majority of engineers in practical work, nevertheless it is an essential and useful tool in the hands of one who can use it. This was the opinion expressed by the author of the paper in closing. It may be said that Mr. Diamant's paper would probably have been more thoroughly discussed had it been given the attention it deserves before being read, for the author pointed out how a practical advantage is secured by a judicious choice of either the rectangular or polar form of complex quantities and the judicial combination of these in dealing with the problems of alternating-current machinery and of transmission lines.

Thin-Plate Batteries for Reserve Service

Considerations Which Have Led the New York Edison Company to Adopt Certain Plate Thicknesses for Emergency Service—Space Requirements and Ratio of Total Battery Rating to Peak and Average Loads

BY PHILIP TORCHIO
Chief Electrical Engineer, New York Edison Company

WITH the advent of large generators and boilers, the capacity of which can be greatly increased by forced draft, the necessity for battery discharge on the peak loads has diminished so that now storage batteries are usually employed only for emergency reserve. The need of a change from the former practice of discharging batteries every day during peak loads to discharging only occasionally at high rates, as is required with present practice, was realized by the New York Edison Company several years ago. At the present time the use of the long-lived and comparatively small capacity batteries formerly employed has been discontinued and a shorter-lived and higher-capacity type has been adopted. The thickness of the plates was determined after considerable study.

The first experimental battery of this type was installed in the Thirty-ninth Street station in 1908. The plates were much thinner than formerly used and were known as pasted or Exide plates, both positive and negative plates having the same ladder-grid construction. In all of the 150 cells except four the positive plates were 20/64 in. thick and the negative plates 17/64 in. thick. In the four cells were 10/64-in. plates. With the co-operation of the battery manufacturer life tests were made on several cells of plates of both thicknesses. Discharges at the hourly rate were made daily until the plates were worn out, the object being to determine the thickness of the plates best adapted to emergency work. It was found that the thinner plates used in the same sized tank as the thicker plates had greater capacity and sufficient life, in number of discharges, to be suitable for the work. After considerable study of the problem it was found that on account of the relative spaces occupied by active plates and wooden separators 10/64 in. was the minimum thickness that a plate should have to give the greatest output per volume of cell. It was observed, however, that the curve showing the relation between thickness of plates and output per volume of cell was flat around 10/64 in. and 14/64 in. thickness of plates, while the life increased and the manufacturing cost decreased with the thickness Therefore it was decided to adopt 14/64 in. and 12/64 in. as the standard thicknesses for emergency-service positive plates and negative plates respectively. The capacity of the 14/64-in. positive plate which is 15 in. wide and 31 in. long, is 150 amp. for one hour.

By adopting these plate thicknesses for central-station service a distinct gain was made in the amount of battery capacity that can be installed in a given space, since at the emergency rate of discharge the capacity obtainable from a pasted-plate battery is as much as three times as great as from a Manchester-Box type battery occupying the same space. This gain was of great value since substations must be located near centers of load which are frequently in districts where the value of real estate is high, necessitating the allotment of minimum space to the various kinds of apparatus used in the converting and storing of electric energy. Another advantage accruing from the adoption of the pasted-plate battery is that interruption of electric service is made a more remote possibility. Some conception of the magnitude of the protection or insurance against interruption of electric service in New York City, and also the cost of such protection may be obtained from a study of the data given in the table on page 78 on the number and size of the batteries which have been and now are installed on the New York Edison Company's system.

With the rating indicated in the table, therefore, the batteries will carry the yearly peak load of the direct-current system for about seven minutes, which would ordinarily be long enough to correct any trouble which might happen to all the generating stations. As the yearly peak load exists for only a few hours, the ratio

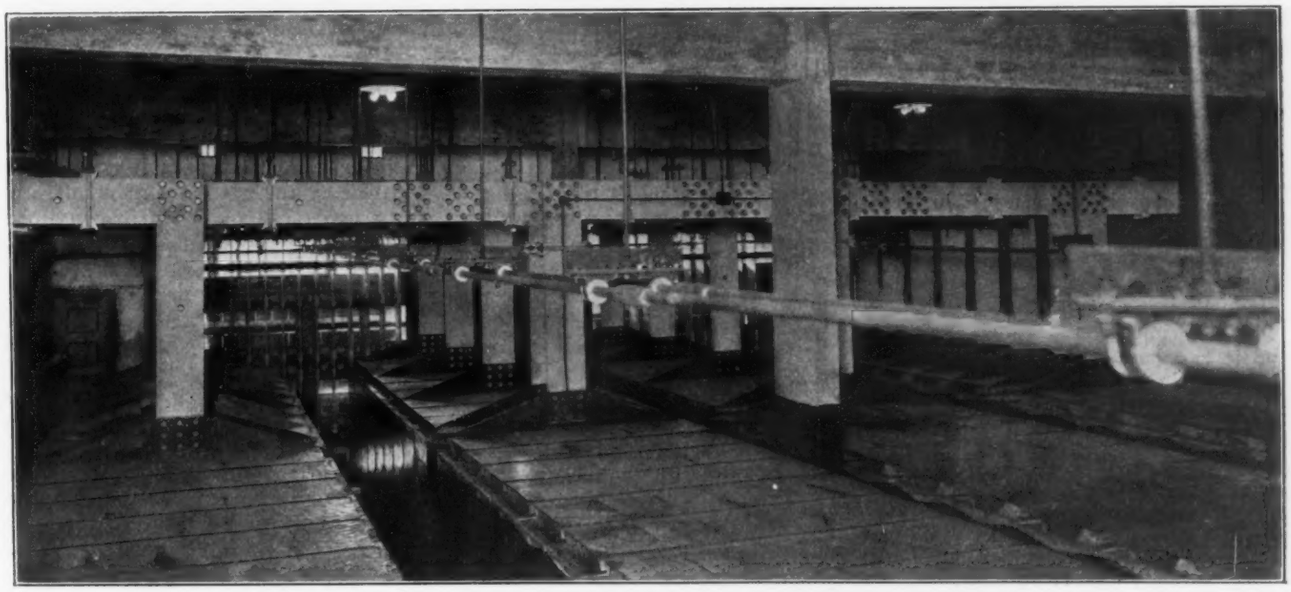


FIG. 1—BATTERY INSTALLATION AT SIXTIETH STREET SUBSTATION OF NEW YORK EDISON COMPANY

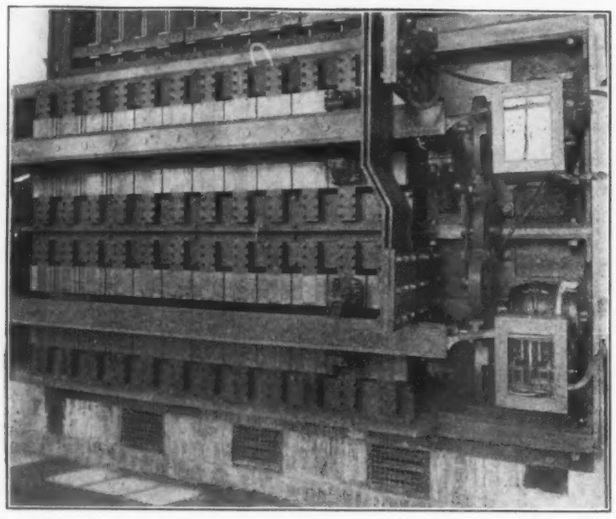


FIG. 2—END-CELL SWITCHES INSTALLED IN ROOM SEPARATE FROM BATTERY ROOM

of battery capacity to load is much larger than stated during the greater part of the year.

Floor-Space Requirements

The four batteries in the Waterside stations float constantly on the exciter buses to insure continuity of excitation but are used primarily for emergency service. The smallest of the substation batteries is composed of 150 cells, each cell containing twenty-nine plates. The largest battery consists of 150 cells, each containing 167 plates. The floor space required for the smallest set is 1800 sq. ft., and for the largest the space required is 2958 sq. ft. One of the accompanying illustrations shows a typical battery installation at the Sixtieth Street station. The regulating or end-cell switches, shown in the other illustration, are located in a separate room immediately in front of the battery room, copper bars being run from the end cells to contacts on the switches. Four end-cell switches are provided with each battery, two for each side of the three-wire system, so that if one switch should fail to operate the battery would not be disabled. The two switches on each polarity are normally operated in multiple.

Method of Charging Main Battery and End Cells

A booster set is used in conjunction with each battery for charging purposes. The design in most general use by the New York Edison Company consists of two 48-kw. generators driven by a 150-hp. motor, all three machines being directly connected mechanically and mounted on a base common to all. Each generator has two commutators which may be connected either in multiple or series giving 1600 amp. at 30 volts or 800 amp. at 60 volts respectively. Each booster is connected in series with the station bus to produce a voltage high enough to charge the battery. Extending over all of the cells is a special bus to which leads may be clamped for charging the individual cells. This bus is arranged so it can be connected to the booster, the latter being provided with a potentiometer type of field rheostat so that it will give a sufficiently low voltage for charging one cell. Since hydrogen, oxygen and acid spray are produced whenever the battery is being charged ventilating apparatus is employed to change all of the air in the battery room once every ten minutes. The apparatus consists of a motor-driven exhaust fan and acid eliminator. The acid eliminator neutralizes the acid fumes before discharging them into the atmosphere.

NUMBER AND SIZE OF BATTERIES EMPLOYED BY NEW YORK EDISON COMPANY TO INSURE RELIABLE SERVICE

No.	Location of Battery	Date of Installation and Type of Battery	*Capacity in Ampere Hours
1	259 W. 123d Street	1899—Manchester	4,000
2	259 W. 123d Street	1907—Manchester	4,000
3	128 E. 121st Street	1900—4000-amp. Manchester.	....
4	128 E. 121st Street (1900 renewed)	1910—Exide	9,000
5	128 E. 121st Street	1905—Manchester	4,000
6	171 W. 107th Street	1905—4000-amp. Manchester.	....
7	171 W. 107th Street (1905 replaced)	1911—Exide	14,800
8	211 W. 84th Street	1900—Manchester	4,000
9	211 W. 84th Street	1912—Exide	9,600
10	123 E. 83d Street	1898—Manchester	4,000
11	170 W. 64th Street	1907—Manchester	4,000
12	155 E. 60th Street	1907—Manchester	4,000
13	155 E. 60th Street	1913—Exide	25,000
14	118 W. 53d Street	1899—8000-amp. Manchester.	....
15	118 W. 53d Street (1899 replaced)	1912—Exide	18,000
16	314 W. 41st Street	1910—Exide	14,800
17	117 W. 39th Street	1898—4000-amp. Manchester.	....
18	117 W. 39th Street (1898 replaced)	1908—8000-amp. Exide	....
19	117 W. 39th Street (rebuilt in 1915)	1903—4000-amp. Manchester.	....
20	117 W. 39th Street	1915—Exide 1915—Exide	18,300 14,700
21	151 E. 39th Street	1907—Manchester	4,000
	151 E. 39th Street	1912—Exide	21,000
24	Waterside Station No. 1	1900—Manchester	4,000
25	Waterside Station No. 1	1903—Manchester	4,000
26	Waterside Station No. 2	1906—Manchester	4,000
27	Waterside Station No. 2	1907—Manchester	4,000
28	452 W. 27th Street	1904—Manchester	4,000
29	44 W. 27th Street	1904—Manchester	4,000
	44 W. 27th Street	1904—Manchester	4,000
30	45 W. 26th Street	1910—Exide	14,800
31	148 E. 26th Street	1913—Exide	25,000
32	27 W. 16th Street	1909—Exide	22,000
33	115 E. 12th Street	1895—Manchester	4,000
34	115 E. 12th Street	1899—Manchester	4,000
35	115 E. 12th Street	1912—Exide	19,200
36	32 Horatio Street	1900—Manchester	4,000
37	32 Horatio Street	1906—Manchester	4,000
38	98 Vandam Street	1903—Manchester	4,000
	98 Vandam Street	1903—Manchester	4,000
39	55 Crosby Street	1898—Manchester	4,000
40	55 Crosby Street	1905—Manchester	4,000
41	55 Crosby Street	1905—Manchester	4,000
42	152 Clinton Street	1903—Manchester	4,000
43	152 Clinton Street	1912—Exide	11,600
44	55 Duane Street	1903—Manchester	4,000
45	55 Duane Street	1903—Manchester	4,000
46	55 Duane Street	1905—Manchester	4,000
47	55 Duane Street	1905—Manchester	4,000
48	33 Gold Street	1899—Manchester	4,000
49	33 Gold Street	1904—Manchester	4,000
50	100 Water Street	1907—Manchester	4,000
51	100 Water Street	1907—Manchester	4,000
52	11 Broadway	1896—Manchester	4,000
Total ampere-hours			373,800
Batteries in service at present		Waterside No. 1 and No. 2	4
		Substations	44
Total			48
Total ampere rating of substation batteries for one hour			357,800
Total ampere rating of substation batteries for seven min.			1,311,200

*At one hour rate of discharge and at 125 volts.

The practice of holding all batteries in reserve for emergencies is universal throughout the system. With the exception of weekly charges and test discharges which are made at intervals of three months on each battery, all batteries float on the system continuously in readiness to take any load that may be thrown upon them. Incidentally the batteries regulate the voltage and assist the balancer to furnish some of the unbalanced current in the three-wire system, especially at times of short-circuits on one side of the system. The weekly charging and test discharging are performed from 12 o'clock midnight to 8 a. m., when the load is lightest, or at a time when the battery to be charged or tested may be taken off the system without lessening the protection to the consumer.

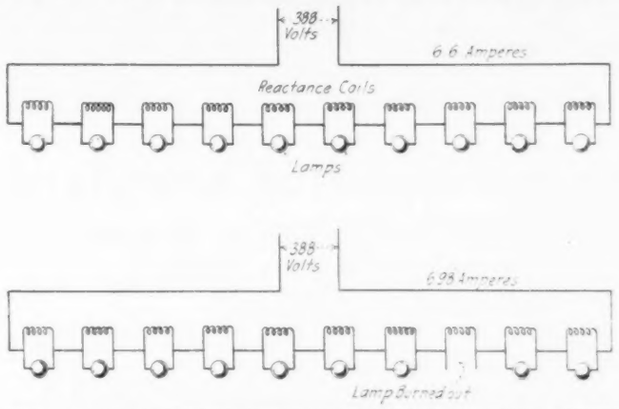
The weekly charging of each battery is of about one hour's duration and is for the purpose of determining the state of charge of the battery generally and to give the inspector opportunity for examining each cell for trouble, such as a low condition of charge due to internal or external short-circuits.

Characteristics of a Series Lighting System

Variations in Current and Power Factor When Lamps Burn Out and the Regulation of a System Using Constant Over-All Voltage

BY ROY E. UPTEGRAFF

IN a series incandescent street lighting system using constant over-all voltage, each lamp has shunted across it a small coil of practically pure reactance, the resistance of these small coils being almost negligible. With all the lamps on such a system burning these coils have the lamp voltage applied across them. At this lamp voltage the coils acquire a small exciting current which is nearly 90 deg. out of phase with the lamp current. This coil current, which is 5 to 10 per cent of



FIGS. 1 AND 2—SERIES CONSTANT OVER-ALL VOLTAGE SYSTEM SHOWING TEN 35-VOLT, 6.6-AMP. LAMPS AND REACTANCE COILS

the lamp current, when added vectorially to the latter makes a line current less than 1 per cent greater than the lamp current. That is if,

I_r = current required by the lamp,

and I_x = current required by the coil.

Then, line current $I = I_r + J I_x$ ..... (1)

In Fig. 1 is shown diagramatically such a system having 10-35-volt, 6.6-amp. lamps with reactance coils across each lamp. Since the reactance coils are in parallel with the lamps the voltage across each coil will be 35 volts. From the curve in Fig. 4, which represents the exciting curve of each coil, the current taken by the coils at 35 volts is 0.35 amp. The line current from

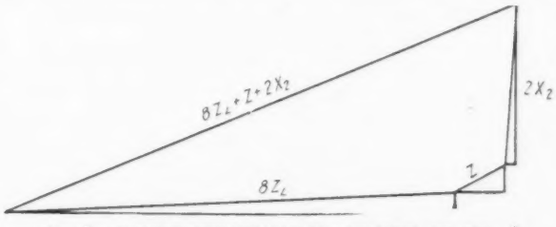


FIG. 3—VECTOR RELATIONS IN CIRCUIT OF FIG. 1

equation (1) then is $I = \sqrt{6.6^2 + 0.35^2} = 6.61$, which is much less than 1 per cent above lamp current.

When one or more lamps burn out the respective coils are required to carry the total line current. Fig. 2 shows the circuit in Fig. 1 with one lamp out. As the voltage across this system remains constant this line current varies according to the regulation curve of Fig. 4. An examination of this curve shows that up to 20 per cent of the lamps burned out the current in the line rises and then drops off. This increase in line current is due to change in the permeability of the magnetic circuit of the reactance coils. This can be shown as follows:

Assume that two lamps have burned out as indicated in Fig. 1. Let the hot resistance of each lamp be R_L; the reactance of each coil be X_1 when in parallel with lamp, and the coil reactance be represented by X_2 when taking full line current. Assume a line drop of 10 per cent and cos φ of line = 0.95 = Z. Then if impedance Z of line equals 10 per cent the resistance of line R = 9.5 per cent. Reactance of line X = 3.16 per cent. The impedance of each lamp with coil will be

$Z_L = \frac{1}{Y}$. Where Y = admittance.

$Y = G + JB$

G = conductance of lamps = $\frac{1}{R_L}$

B = susceptance of coil = $\frac{1}{X_1}$

$R_L = \frac{35}{6.6} = 5.3\omega$; $X_1 = \frac{35}{0.35} = 100\omega$

$Y = \sqrt{0.189^2 + 0.01^2} = 0.1892$; $Z_L = 5.29\omega$

$\text{Cos } \theta = \frac{Z_L}{R_L} = 0.998$

The reactance X_2 of coils when taking line current = 10.7ω from curve Fig. 4. For this calculation we will assume that the reactance coils have no resistance, which

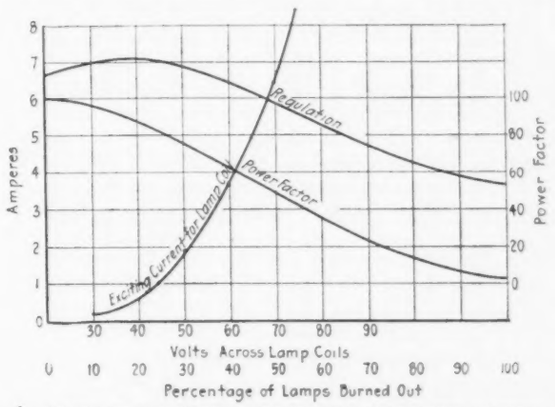


FIG. 4—LAMP COIL EXCITING CURRENT AND POWER FACTOR AND REGULATION CURVES FOR SYSTEM

will make the phase angle of the coil zero degree. If with all the lamps burning the over-all voltage is 388 and the line carries 6.61 amp., then the normal impedance of the circuit Z_t is,

$$Z_t = \frac{388}{6.61} = 58.7\omega$$

Assume the line impedance Z = 5.8. Then the total impedance with two lamps burned out will be,

$$8Z_L + Z + 2X_2 = \frac{8R_L X_2}{X_2 + JR_L} + R + JX + J2X_2 = 54.7\omega = Z_t$$

This calculation is shown vectorially in Fig. 3. The current I when two lamps have burned out becomes,

$$I = \frac{E}{Z_t} = \frac{388}{54.7} = 7.09 \text{ amp.}$$

which is greater than the normal current when no lamps are out.

The above numerical calculation is not exactly what will take place in practice, because when the current increases to 7.09 amp. the resistance of the lamps will

change. In the calculation this was assumed to be constant.

The power factor of this system changes when lamps burn out, according to the power factor curve of Fig. 4. The decrease in power factor can readily be accounted for, because more and more of these coils, which are practically pure reactance, are cut into the circuit while the resistance component of the circuit (the lamps) is cut out. That is, the circuit changes from resistance to reactance, and therefore the power factor from nearly 100 per cent to practically zero per cent.

This system operates very well because of the high power factor when all the lamps are burning and the good regulation. Although the power factor decreases as lamps burn out, it is never less than 97 or 98 per cent under normal operation. As observed from the regulation curve of Fig. 4, the current does not drop below normal until 35 per cent of the lamps have burned out. The efficiency of the system is also high, being around 95 per cent, because the only addition loss outside of line loss is that due to the core and copper loss of the coils, which under normal operation is very small.

This system has an advantage over those using constant current transformers and film cut-out lamp sockets because of the higher power factor and higher efficiency. The power factor of the current transformer is necessarily low, owing to the design, and is approximately between the limits of 83 and 90 per cent. As regards regulation of the two systems, the system using reactance coils regulates the current electrically when the lamps burn out, while the constant current transformer regulates the current by mechanical means. Here again the system using reactance coils has an advantage in that the current is regulated instantly, while the mechanical action of the other system must take place before the current is regulated. On account of the mechanical action being slower than electrical action, there may be an instant of considerable high current in the balance of the lamps which may at times be detrimental.

Timing Relay Operation With a Rotating Standard

Tests to Show That a Rotating Standard Watt-Hour Meter Is Preferable to Stop-Watch in Measuring Small Intervals of Time—Accuracies Based on Cycle Recorder Readings

BY W. H. FELLOWS

Superintendent Meter Department, Potomac Electric Company, Washington, D. C.

FROM experiments conducted by the writer in which a rotating standard watt-hour meter was used to serve as a cycle recorder, the conclusion was reached that higher accuracy can be obtained by their use in timing relay operation than with stop-watches. The voltage and frequency used in conducting the experiments varied slightly as most commercial voltages and frequencies do, nevertheless the difference between the results obtained with the rotating standard and a cycle recorder was only about 5 per cent at the most.

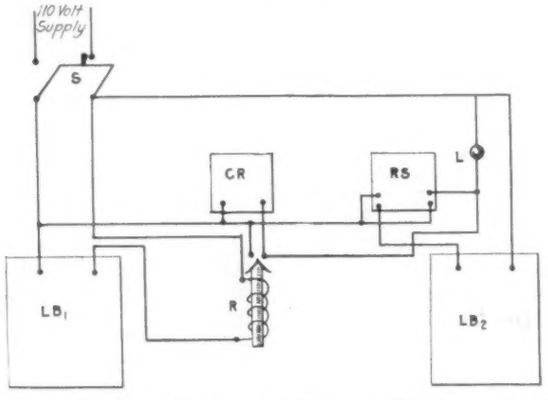


FIG. 1—CONNECTIONS* FOR CHECKING ACCURACY OF ROTATING STANDARD AS TIME RECORDER AGAINST CYCLE RECORDER

The instruments and connections used to check the accuracy of the rotating standard as a time recorder are indicated in Fig. 1. The first rotating standard used was of the alternating-current type and the cycle recorder, a Holzer-Cabot instrument with one pair of terminals. When switch *S* is closed four circuits are completed. One includes load LB_1 and relay *R*, another the cycle recorder *CR*, and 80-watt lamp *L*; another potential coil of rotating standard *RS* and lamp *L*, and another current coil of *RS* and load LB_2 (LB_2 should have a zero temperature-coefficient resistance, and therefore a lamp bank should not be used. In the experiments a General Electric meter-testing rheostat was used). With these connections both *CR* and *RS* will record until *R* operates, when both instruments will stop. By keeping *R* from operating, the duration of a cycle, in fractions of a second, can be obtained by letting *CR* run for one minute or longer. Similarly the time, in fractions of a second, required for the pointer of *RS* to pass through one of the hundred divisions can be obtained. In one particular series of tests the cycle duration was 0.0162 second, and the value of one scale division on the rotating standard was 0.021 second. By timing different cycles with a cycle recorder and rotating standard simultaneously the following results were obtained:

TABLE I—RELATIVE ACCURACY OF ROTATING STANDARD AS TIME RECORDER

Test	Time of Cycle in Seconds with Rotating Standard	Time of Cycle in Seconds with Cycle Recorder	Discrepancy of Rotating Standard in Seconds	Discrepancy of Rotating Standard in Per Cent
1	0.267	0.275	—0.008	—2.91
	0.264	0.259	0.005	1.93
	0.267	0.275	—0.008	—2.91
	0.263	0.259	0.004	1.54
2	0.513	0.502	0.011	2.19
	0.513	0.486	0.027	5.44
	0.503	0.502	0.001	0.20
	0.513	0.502	0.011	2.19
3	1.47	1.47	0.000	0.000
	1.67	1.62	0.02	1.23
	1.66	1.70	—0.04	—2.35
	1.60	1.62	—0.02	—1.23
4	3.11	3.16	—0.05	—1.58
	3.26	3.30	—0.04	—1.21
	3.40	3.47	—0.07	—2.01
	3.24	3.24	0.000	0.000
5	7.95	8.00	—0.05	—0.63
	8.11	8.18	—0.07	—0.85
	8.05	8.09	—0.04	—0.49
	7.86	7.76	0.10	1.29

Taking the reading of the cycle recorder as a basis for comparison it may be seen from the foregoing data that the rotating standard indicated slightly less than the actual time in most cases except test No. 2. In no

*See footnote, page 81.

case, however, did the discrepancy greatly exceed 5 per cent, the average being about 1.6.

Following these tests an experiment was conducted to determine the relative accuracies of a cycle recorder, rotating standard and stop-watch. The latter was of the type having a sweep hand, which makes one rotation in thirty seconds. An expert stop-watch operator was employed in the test, with the following results:

TABLE II—RELATIVE ACCURACIES OF ROTATING STANDARD AND STOP-WATCH AS TIME RECORDERS

Cycle Recorder (*CR*)	Rotating Standard (*RS*)			Stop-watch (*SW*)		
Reading, Seconds	Reading, Seconds	Discrepancy Seconds	Discrepancy Per Cent	Reading, Seconds	Discrepancy Seconds	Discrepancy Per Cent
9.86	9.74	—0.12	—1.22	9.9	0.04	0.41
4.03	4.03	0.00	...	4.3	0.27	6.7
4.12	4.12	0.00	...	4.25	0.13	3.16
1.41	1.46	0.05	3.54	1.6	0.21	14.9
1.52	1.52	0.00	...	1.65	0.13	8.55
0.275	0.282	0.007	2.54	0.4	0.125	45.5
0.307	0.296	—0.011	—3.58	0.5	0.193	62.8

From these comparisons it is evident that stop-watches are entirely unsatisfactory for measuring short periods of time, the discrepancies reaching almost 63 per cent

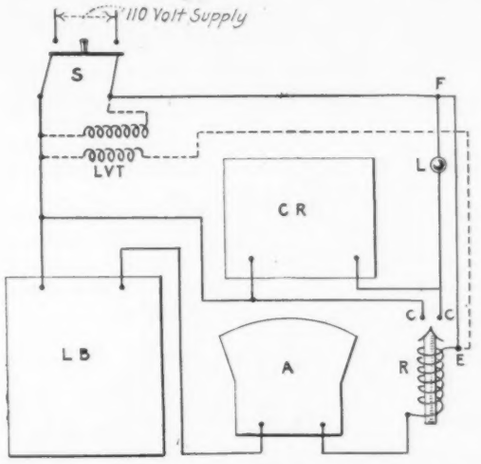


FIG. 2—ARRANGEMENTS* FOR DETERMINING RELAY-OPERATING TIME WITH A CYCLE RECORDER

in the tests made where 0.307 second was the shortest time determined. On the other hand, the discrepancies of the rotating standard did not exceed 3.58 per cent based on the cycle-recorder readings. Since the speed of a watt-hour meter varies with the square of the voltage, it is obvious that a rotating standard will be more accurate for measuring time when the voltage is maintained constant. The accuracy of a cycle recorder depends, however, on the constancy of the frequency.

Since making the experiments described, the writer has concluded that a suitable resistance of zero temperature coefficient material should be used in place of lamp *L*, especially when using the rotating-standard method. Experiments have also been conducted with a direct-current rotating standard. To substitute it for *RS* in Fig. 1, a storage battery was used for loading the current coils and 120-volt direct-current energy employed for energizing the potential circuit of the meter. The behavior was not quite as good as with the alternating-current rotating standard, but it would be preferred to a stop-watch. The discrepancy between the rotating standard and cycle recorder was sometimes as much as 5 per cent, but it is evident that 5 per cent of one second is a very small interval of time. This discrepancy is partly due, the writer believes, to the difference in torque of a commutator meter when the brushes are straddling commutator bars and when each brush is resting on but one bar. The rotating standard used was a Mobray meter, which has potential-circuit resistance with a very low temperature coefficient.

Figs. 2 and 3 indicated connections which may be employed in using cycle recorders to measure the time required for any relay to operate and to determine the difference in time of operation of two relays. Referring to Fig. 2, it may be noted that when switch *S* is closed one circuit is closed through load *LB*, ammeter *A*, and relay *R;* another through 50-watt lamp *L* and cycle recorder *CR*. Immediately upon closing switch *S* the cycle recorder begins to record, and will continue to record until the relay closes contacts *CC*, when the cycle recorder stops and the 50-watt lamp lights up, thus giving a signal to open switch *S*.

Fig. 3 shows connections used to determine difference in time of operation (selective feature) of two relays. As soon as R_1 operates the cycle recorder begins to record, since the circuit is closed through cycle recorder *CR* and lamp *L*. It continues to record until R_2 operates. The reading of cycle recorder gives the difference in time of operation of the two relays.

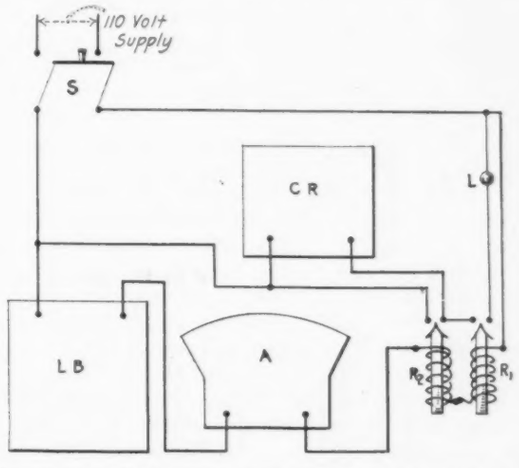


FIG. 3—CONNECTIONS* FOR DETERMINING DIFFERENCE IN TIME OF OPERATION OF TWO RELAYS

In testing relays it is desirable to test them at short-circuit loads, which means 50 to 100 amp. The impedance of some relays is so high, however, that 110 volts is usually required to force the current through them. Others have a lower impedance, consequently a lower voltage can be used to force current through the relays. When the lower voltage is desired it may be obtained by connecting low voltage transformer *LVT*, as shown by dotted lines in Fig. 2 and omitting connection *EF*.

*S is a switch, CR is cycle recorder, RS is rotating standard, L is lamp, R is relay, LB is load box and A is an ammeter.

Inspection Test That Shows Poles Cut from Dead Cedar Trees

To secure a maximum life and greatest strength from cedar poles, it is important that the tree be alive when felled. Poles from dead trees can usually be checked up during inspection, for live cedar always has a ring of white sapwood surrounding the heartwood. No matter how unsightly or discolored the exterior of the pole may be, a shaving from a live pole will show white sapwood. It occasionally occurs that a dead streak, caused by injuries to the growing tree, will be found on a pole. If the dead sapwood covers only a small part of the circumference and is shallow, not extending into the heart of the tree, it does not necessarily affect the strength of the pole, but a pole encircled with gray dead sapwood is brittle, without elasticity and unfit to bear any strain.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SECTIONALIZING SYSTEM WITH ISOLATING TRANSFORMERS

Use of One-to-One and Step-Down-Step-Up Transformers by Illinois Company to Reduce Disturbances from Accidental Arcing Grounds

On the lines of the Public Service Company of Northern Illinois practical use has been made for sometime of the isolating transformer idea on a non-grounded neutral system. The general features of this practice were outlined in a paper by O. O. Rider, assistant to the general superintendent of this company, presented at the recent Cleveland meeting of the A. I. E. E.

The usual plan, as worked out, provides for isolating the system at generating stations or at points where local distributing lines are supplied. As may be observed from the accompanying single line diagram (Fig. 1), this arrangement exists at the Blue Island and Streator stations. The step-up transformer banks normally operate in parallel on the generating bus, but are isolated on the high-tension side. Provision is made, however, for parallel operation on a high-tension bus at Blue Island, or for cutting the line through and bypassing the station at Streator, in case of transformer trouble or other unusual conditions. In this manner the system as a whole operates in parallel but in isolated sections, thus limiting in extent metallic inter-connections and consequent disturbances to restricted areas.

At the Streator installation, station-type regulators are installed on the low-tension side of the step-up transformer bank, which maintains proper regulation for the intervening points along the line extending to the west. This appears to be one of the main advantages of the isolating scheme as worked out in the system of high-voltage distribution.

In the case of a metallically inter-connected system, a single defective insulator which grounds a phase affects the entire system. Local storms often develop in one section and cause a hazard to service in every other section. When isolating transformers are installed the disturbance of an accidental arcing ground on one section is confined entirely to that section, and still power may be transmitted without interference to and from all other sections as under normal conditions. Where isolating transformers are installed 1 to 1 units may be used or standard units which step the voltage down and up again to the transmission voltage. Delta connection of transformers is employed.

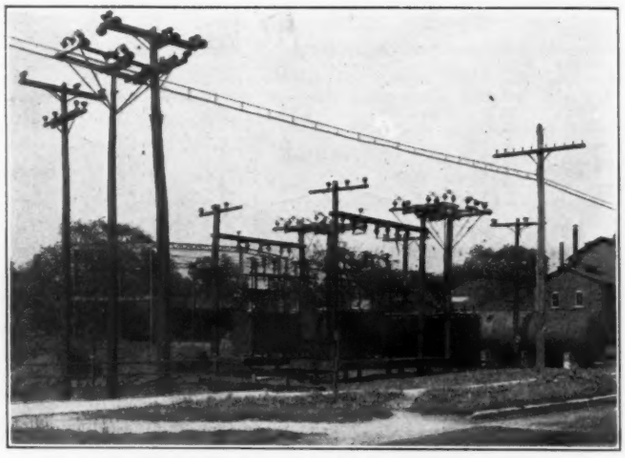


FIG. 2—TWO BANKS OF STANDARD TRANSFORMERS CONNECTED AS SHOWN AT MORRIS FOR ISOLATING PURPOSES ONLY

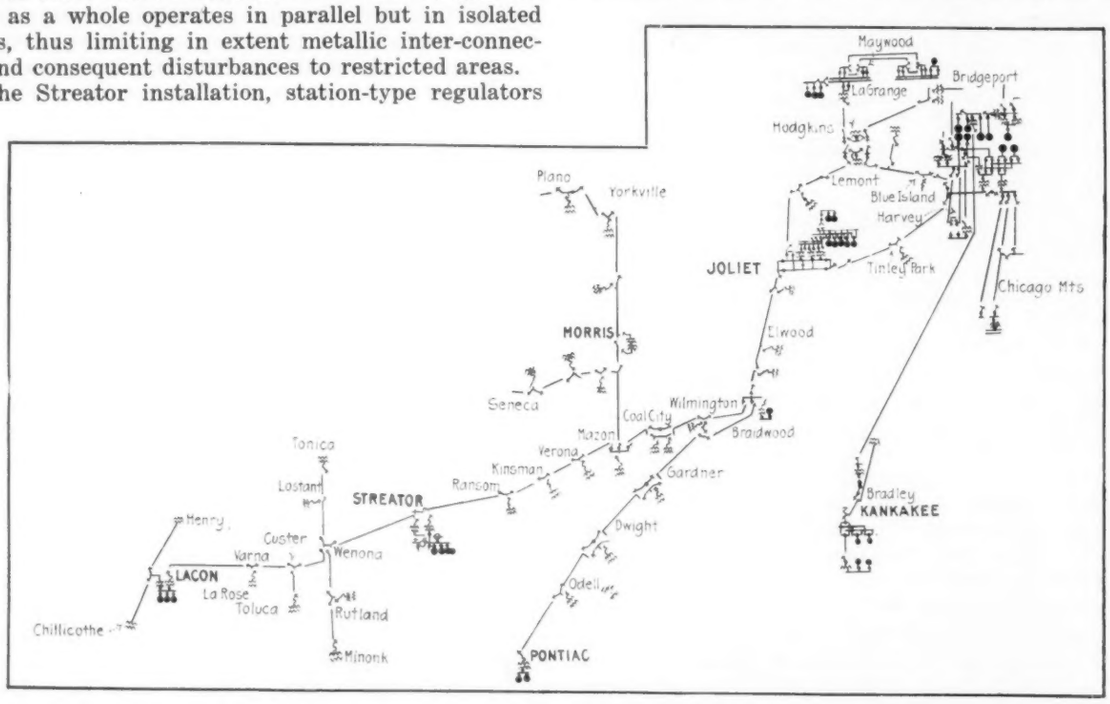


FIG. 1—TRANSMISSION SYSTEM OF PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS, SHOWING ISOLATING ARRANGEMENTS AT BLUE ISLAND AND STREATOR STATIONS

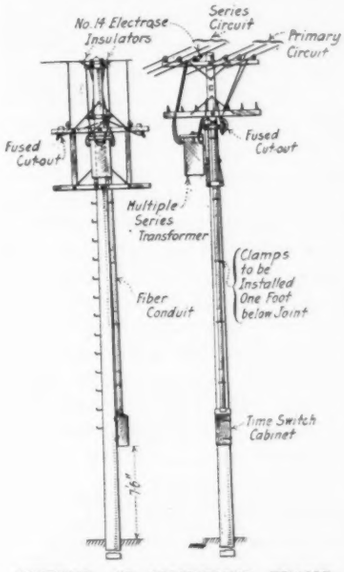
In Fig. 2 is shown an outdoor installation consisting of two banks of standard transformers protected on both high-tension sides by electrolytic lightning arresters. The transformers are considered as a part of the line equipment, and are installed in the line extending to the north of Morris for the advantages of isolation alone.

In the development of high-voltage distribution systems, consisting of an inter-connected network of lines, the necessity of protective devices for localizing high-voltage disturbances becomes more and more apparent as the system is extended. The scheme of adapting the transformer for this purpose is proving to be an effective means in limiting the extent of line disturbances, and unless some protective device is developed which will fulfill the requirements the transformer will be used, but perhaps in a modified form, designed for the conditions imposed.

Pole-Top Installation for Feeding and Controlling Series Lighting Circuits

BY R. A. PAINE, JR.

To feed and control series street lighting circuits containing nitrogen-filled lamps shunted by reactors, the Edison Electric Illuminating Company of Brooklyn has installed thirty-two pole-top multiple-series transformers and as many time switches in the manner illustrated herewith. The transformers are 10-kw. General Electric units designed for 2400-volt primary pressure and 6.6-amp. secondary current, while the clock switches are oil-inclosed A. & J. M. Anderson devices designed for 3300-volt, 25-amp. service. As indicated, each transformer is attached to cross-arms just below and at right angles to the cross-arm carrying the primary and series circuits. At the outer ends of the upper transformer cross-arms are attached fused cut-outs which are connected between the primary circuits and the time switch. The latter is inclosed in a wooden cabinet provided with a lock and fastened to the pole 7 ft. 6 in. above the ground. The time switch in turn is connected with the primary terminals of the transformer.

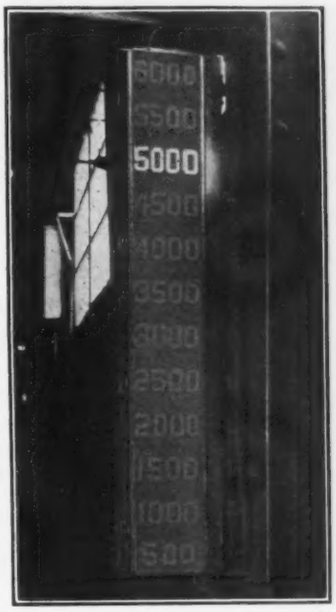


METHOD OF MOUNTING TRANSFORMER AND TIME SWITCH ON POLE

The conductors leading to and from the time switch are No. 4 wires insulated with 8/32-in. rubber and heavy braid. From the top transformer cross-arm to the time switch cabinet they are inclosed in a 3.5-in. fiber pipe having 7/16-in. walls. To simplify connecting the secondary winding of the transformer with the series circuit, the latter has been strung on the cross-arm like a continuous conductor, the only difference being that the section supported on the insulator is insulated from the conductors approaching the insulator by "electrose" strain insulators. Jumpers connect the conductors dead-ended in this manner directly with the secondary terminals of the transformer.

Home-Made Load Indicator Helps Firemen Control Boiler Fires

In the boiler room of the Rockford (Ill.) Electric Company, a home-made device has been installed to keep firemen informed of the kilowatt load carried. This device consists of a series of incandescent lamps in a long vertically-mounted box with glass sides which are made opaque, except where numbers are placed as shown in the accompanying illustration, allowing the light to shine through and indicating the load carried in kilowatts. Partitions are placed in the box between lamps, so that only one number will be illuminated at a time. The operator controls the lamps from the switchboard gallery by simply plugging in the right circuit. By watching this load indicator, which is mounted midway along the firing aisle and can be seen the full length of the boiler room, the firemen are able to control the boiler fires much more closely to suit the demand than by watching the steam pressure only.



HOME-MADE LOAD INDICATOR

Testing Large Water Wheels in Winter Time

At a recent hearing before the Massachusetts Gas & Electric Light Commission, methods of testing hydraulic turbines in the station of the Turners Falls Power & Electric Company were outlined. The wheels are of the I. P. Morris vertical type, and each is direct connected to a 7500-kva., 6600-volt generator. The efficiency of the wheels was sought, and while the results were not in hand at the hearing, the methods used are of interest on account of the large scale of the measurements.

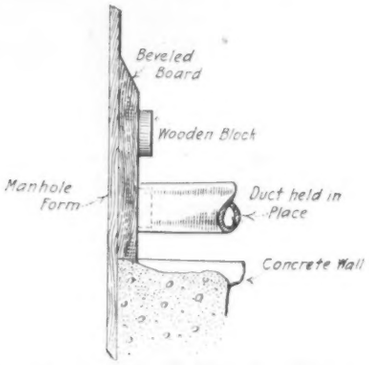
To determine the efficiency it was necessary to measure the power output of the wheel, the head and the quantity of water used. The output was measured electrically and corrections were then made for generator efficiency. The head was measured by gages in the wheel case and in the river. To obtain the quantity of water, two methods were used; one, a current meter measurement and the other a bulk measurement, pulling down the water in the pond and accurately surveying its area. The current meter was used in the canal just in front of the wheel to be tested. In order to separate the test unit from the other units, a flume about 40 ft. long was built in front of the openings to the head gates. Two current meters were used in this flume. The current meter measured the velocity of the water, and by taking the average velocites as measured over the whole width of the flume and multiplying by the area, the amount of water used in a given time was figured.

The test was somewhat complicated by being made in winter, and for this reason bulk measurement was used, ice on current meters sometimes being troublesome. The

pond measurements required more time and were not so frequently made, but the two methods checked within 1 sec.-ft. out of 1600 sec.-ft. The amount the pond was drawn down was measured on twenty-two gages up and down the length of the canal, as the variation in different places needed to be considered. At various times twenty-eight men were reading gages. A test run required two hours. The ice on the pond made it easier to get an accurate measurement of the drawing down of the water, no wind effects being present. Every gage was in a small hole cut in the ice and the water was perfectly still. There was some leakage out of the canal which was measured by closing the cofferdam gates at night, and measuring the reduction in canal level.

A Method of Recessing Duct Entrances Into Concrete Manholes

In underground construction work, the manner in which the duct line is led into the manhole bears an important relation to the efficient operation of the cables. Many utility companies have specifications for the manufacture of cables and incorporate a clause relative to a bending test to be made over a drum equal in diameter to a certain number of times the diameter of the cable.



FORM FOR SPACING FIBER DUCT AND RECESSING ENTRANCES IN CONCRETE MANHOLES

Often in the construction of the duct line the entrance into the manhole is so sharp that unless extreme care is used in training the cable the bend in the cable from the duct line to the side of the manhole will be much shorter than it is safe to make.

This condition has brought forth special fittings intended to eliminate the necessity of a sharp bend. With vitrified clay conduit or multiple duct, the section which enters the manhole has the distance between the ducts gradually increased so as to allow plenty of room between cables as they emerge into the manhole. In brick manholes a special form of bull-nosed brick is used so as to form a recess with curved sides about which the cable may be trained without the danger of a sharp bend or of the cable being cut on the sharp edge of the duct.

In building concrete manholes and using fiber as the duct material, it is the practice of many companies to place a wooden form in the hole and then lay the fiber duct against the form as the side of the manhole is constructed. When finished, the duct and wall form a right angle, presenting a sharp edge to the cable sheath. To obtain the same result as secured with the bull-nosed brick, a board of suitable size with a 2-in. or 3-in. bevel may be nailed to the form and the duct pushed against this, with the result that when the manhole is completed the duct entrance is recessed.

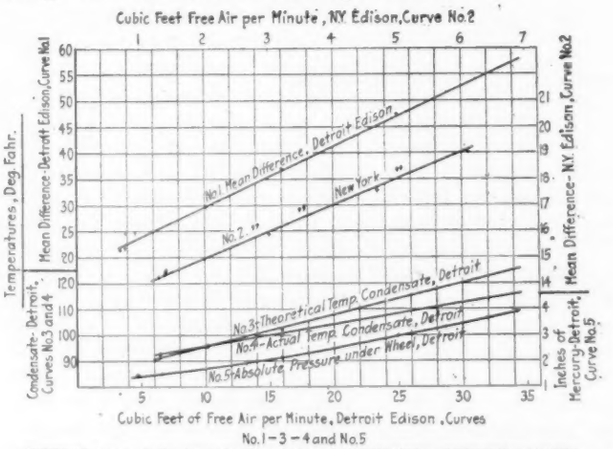
Multiple tile is by its construction spaced previous to being laid, while fiber duct must be spaced by the use of sticks or rakes as the concrete envelop is poured. This makes it difficult to always get the proper spacing in the manhole. To secure this spacing, the beveled board may be fitted with round blocks having a diameter equal to the inside of the fiber conduit. These blocks are nailed on the board and will serve to hold the conduit until the concrete has been poured.

Removing Enamel from Magnet Wire to Measure Diameter Accurately

A manufacturer of magnet wire states that many serious mistakes are made in measuring the diameter of enameled wires. Many users scrape the enamel from the copper wire with emery cloth or sandpaper. In doing this it is almost impossible to keep from removing some of the copper. If only 0.0001 in. is removed, it will show on a micrometer caliper or wire gage. Two ways to remove enamel from wire are suggested: One of these is to pass the wire over a bunsen gas flame several times until the enamel melts and drops off; the other is to dissolve it in amyl alcohol.

Effect of Air Leakage on Condenser Efficiency

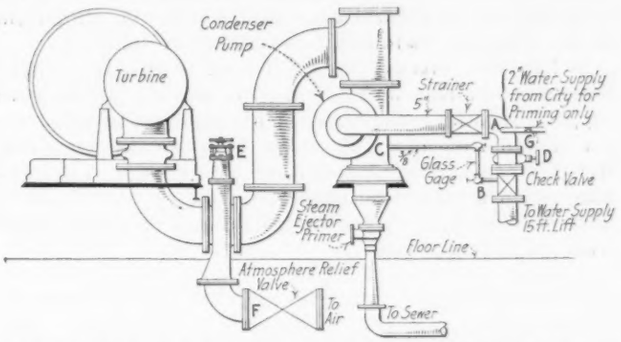
The accompanying curves, which represent the effect of air leakage in condensers on the mean temperature difference, condensate temperature and absolute pressure under the wheel, indicate that each of these quantities increases at an approximately uniform rate with increase in air leakage. The curve referring to a New York Edison condenser was plotted from gasometer readings obtained under approximately equal loads but with different circulating water temperatures. The remaining curves are based on performance data relating to an old condenser used at the Delray station of the Detroit Edison Company. Instead of operating the unit under normal conditions air was admitted through nozzles inserted opposite the air cooler and above the top row of tubes. According to the recent report of the N. E. L. A. prime mover committee which presented these data, the nozzles were employed to permit controlling the air leakage and to serve as a check on the gasometer readings. It may be pointed out that the rates of increase in mean temperature difference were about 1.04 and 1.16 deg. Fahr. per cubic foot of free air leakage per minute in the two cases. At a high rate of air leakage (34 cu. ft. per minute) the condensate temperature was about 10 deg. Fahr. below the theoretical value. In addition the pressure under the wheel increased about 3.4 in. of mercury with a change in air leakage of 5 cu. ft. to 34 cu. ft. per minute.


Cubic Feet Free Air per Minute, N.Y. Edison, Curve No.2
Temperatures, Deg. Fahr.
Condensate-Detroit, Curves No.3 and 4
Mean Difference-Detroit Edison, Curve No.1
Mean Difference-N.Y. Edison, Curve No.2
Inches of Mercury-Detroit, Curve No.5
No.1 Mean Difference, Detroit Edison
New York "
No.2 "
No.3-Theoretical Temp. Condensate, Detroit
No.4-Actual Temp. Condensate, Detroit
No.5-Absolute Pressure under Wheel, Detroit
Cubic Feet of Free Air per Minute, Detroit Edison, Curves No.1-3-4 and No.5

EFFECT OF AIR LEAKAGE ON CONDENSER PERFORMANCE

Scheme for Priming Rotary Condenser Pump Without Use of Steam Ejector

In the municipal lighting plant at Dowagiac, Mich., where a new geared-type double-nozzle turbo-generator unit has recently been placed in operation, a scheme for priming the Westinghouse Le Blanc condenser upon starting, is used by W. E. Reynolds, superintendent, which he claims to be more satisfactory than the usual steam ejector method.



PIPE CONNECTIONS FOR PRIMING ROTARY CONDENSER PUMPS

The method used is shown in the accompanying drawing. A 2-in. water pipe supplying water at 60-lb. pressure was tapped into the main condenser water supply pipe at *A*, and a ⅜-in. pipe, including a glass gage with a valve at top and bottom, was inserted between the condenser intake water pipe and the exhaust side of the condenser pump housing, and tapped in at *B* and *C* as shown.

To start up the unit, steam is turned on the turbine which operates non-condensing to begin with, and exhausts to atmosphere through the valve *E* which is normally open, and through the automatic atmospheric relief valve at *F*. As soon as the generator with its exciter mounted on the same shaft comes up to speed so as to supply energy to the induction motor driving the condenser pump, the latter is connected in service. The valve in the city water line at *G* is then opened, supplying water to the rotating pump which throws it down through the discharge and starts a vacuum. After the water has been turned on a moment the valves above and below the glass gage are opened and as soon as water appears in the gage, the valve *D*, which has been closed up to this point, is opened at the same time *G* is closed. The valves in the gage line are then closed and the condensing process proceeds. This method of priming has been so satisfactory that the steam primer has not been connected up.

Washing Power Station Wipers and Oily Cloths Effects Considerable Saving

The widespread effort toward economy has brought to light numerous ingenious and interesting methods of renovating materials that not very long ago would be cast aside as useless. One of these is the cleaning of wipers or cloths in power houses. In large power houses wipers are used for multitudinous purposes about machines and in the boiler room. The work is rather severe, and cloths or rags do not remain in fit condition very long. However, when cleaned their useful life can be increased several hundred per cent. One large central station company is successfully renovating or cleaning wipers, some of which are the ordinary woven goods with two selvaged edges and two hemmed edges, while others are ordinary rags, which cost about half that of the former.

A centrifugal washing machine has been installed in the power house and within easy range of the boiler room, so that steam and hot water may be supplied directly to the washer. When sufficient cloths have collected—the machine has a capacity of sixty rags at a washing—they are treated with steam for about twenty minutes to remove the oil. They are then placed in the centrifugal washing machine and subjected to boiling for some forty minutes in a solution of special soap powder. At the end of the forty minutes the washing solution is run off and clean hot water is poured in for some twenty minutes. The washing machine is revolving all the time, about one and one-half hours. The cloths are then taken out of the machine, hung up and allowed to dry. The number of times the rags can be washed depends upon the quality of the cloths and the service to which they are subjected. Under the severest conditions three washings are usually possible. The cost of washing averages about one-fifth the purchase price.

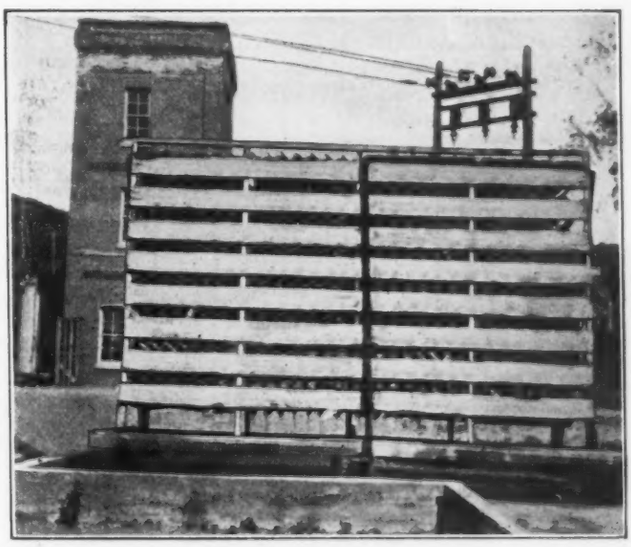
Cooling Towers for Transformer Installations Used by New England Company

The accompanying illustration shows a design of cooling tower used in connection with transformers at substations by the New England Power Company. The dimensions of these towers vary according to local conditions. A design similar to the one illustrated is installed at Pawtucket, R. I., and measures 13.5 ft. long, 10.5 high, and 5 ft. wide. The cooling surface consists of 600 boards, 8 in. by 5 ft., providing a total surface of 2160 sq. ft. The boards are arranged as horizontal V troughs and nailed to the horizontal sides of the frame as shown.

In summer the temperature of water is reduced on the average 25 deg. Fahr. with 20 gal. of water flowing over the tower per minute. The cost of building this tower complete was $170, divided into the following items:

Lumber	$77.00
Piping	50.00
Labor	40.00
Miscellaneous	3.00
Total cost	$170.00

Cooling towers of similar design are used by the company at substations located at Fitchburg, Clinton and Ware, Mass.



SMALL HOME-MADE COOLING TOWER USED FOR SUBSTATION TRANSFORMERS

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

St. Louis Gains Another 5000 Customers; Reduces Rates Another Half Cent

A reduction of 0.5 cent per kilowatt-hour in rates for service has been announced by the Union Electric Light & Power Company. This reduction follows as the result of a gain of more than 5000 customers since the last reduction of 0.5 cent last December, bringing the total number of customers at present to more than 70,000.

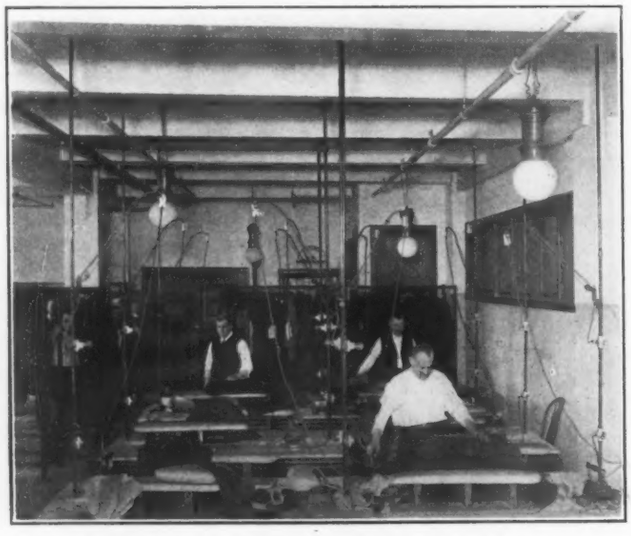
It had been promised that this reduction would be made when the number of customers should thus reach 70,000, and at the time the new rate was announced to take effect A. C. Einstein, general manager of the company, stated that another reduction of 0.5 cent will be made when the number of customers reaches 75,000.

The first step in the rate schedule is now reduced from 9 cents to 8.5 cents per kilowatt-hour, the second from 6.5 to 6 cents, and the third from 3.5 cents to 3 cents. The first step applies to the first 4 kw.-hr. used for each room in a month, the second step applies to the next 3 kw.-hr., and the third to all in excess of 7 kw.-hr.

For the purpose of calculating these rates, three bedrooms are exempt from the room count. The minimum charge to residence customers remains at 50 cents a month, but no deposit is required.

Tailor Irons with Regulating Stands

In the tailor shop of Brokaw Brothers' new store near Times Square, New York City, the twenty-six 15-lb. Simplex tailor irons are equipped with automatic regulator stands so arranged that every time an iron is set on its stand the current is reduced 25 per cent. This not only makes a large saving in the cost of energy in the course of a year, but also prevents the iron from getting too hot in case the tailor leaves it for a time, as often happens. The iron also has a cord support which keeps the cord out of the way of the operator. The arm has a double spring which allows it to move in any direction, and on the cord support is mounted a snap switch. A pilot light shows when the switch is turned "on" or "off."



CURRENT FLOW IS REDUCED WHEN IRON RESTS ON STAND

A separate circuit for each iron is run in conduit across the ceiling and connects to the top of the cord support, making a very neat and permanent installation. An installation like the above will remain in operation for years, since repairs are minimized. The cord support prevents breakage and the regulator stand protects the iron if it is forgotten and left over night with the current on.

MANAGERIAL PROBLEMS

Executives of Michigan Central Stations Discuss Public Relations, Street Lighting from the Policy Standpoint, Standardization, and Electric-Range Results

Problems of the executives of central station companies in their relations to their customers, to the public and to the public's regulatory bodies, were interestingly discussed during the sessions of the Michigan Section of the N.E.L.A., on board the steamer Arizona while cruising on the Great Lakes from June 18 to 22, as already reported in these columns.

H. H. Crowell of the administrative department of the Hodenpyl-Hardy Company, Jackson, Mich., in a paper entitled "The Community and the Utility," pointed out the significance of the fact that companies incorporated for the purpose of furnishing electric service are organized for periods of not more than thirty years, although under the general laws of Michigan one or more extensions of life terms may be provided for. The provisions for extension of life, said he, seem to recognize, however, the fact that such corporations are organized to construct public service works, the usefulness of which would be longer than thirty years.

FRANCHISES PROCEED FROM THE LEGISLATURE

Further, said he, it is well to note that notwithstanding the creation of municipalities, the Michigan Legislature may yet grant franchises to be exercised within State boundaries. Through the State constitution itself or by legislative act, municipalities may have conferred upon them exclusive power to grant franchises, it being understood that the act of the Common Council in such cases is merely delegated power of the Legislature through the Council as an agency. . . . A franchise, he pointed out, is essentially in all respects property, and is governed by the same rules as to enjoyment and protection, and is regarded by law precisely as is property. It is the property value of franchises only which impart value to them.

Of water-powers Mr. Crowell said: "The State (of Michigan) has no right of ownership or control in a proprietary sense. Its rights are confined to those of a sovereign power of control for the public use of navigation. All proprietary-right interests belong to the riparian owner, and extend to beneficial uses of the water-power, including revenue therefrom. The property rights are subject only to the paramount control of the government for the definite and specific purposes of

protecting navigation. The private right persists up to the point where its exercise becomes an unreasonable interference with the public right. Hydroelectric developments in Michigan have done much to accelerate industrial progress, and the policy of interesting foreign capital for such development is of economic value to citizens of the State."

The speaker also pointed out that the slow rate of turnover of capital in the utility business made it essentially different from an ordinary manufacturing business. He advocated that laymen who discuss utility problems become acquainted with the fact that a complete capital turnover in this field usually requires a period of from five to seven years.

In closing the speaker took a fling at municipal ownership, and declared that public utilities should never furnish an impersonal service. They should scout the idea that a corporation has no soul. "The managers must make the people believe in them and in their real desire to serve. Good-will is our chiefest asset, and we must have men with judgment and tact to get it and to keep it for the utility. As to public policy in general, I hesitate to speak," said he. "Lincoln never had a policy. He tried to do what seemed best each day as each day came. That is a good rule to keep in mind in operating a public utility."

KEEPING THE GOOD-WILL OF THE PUBLIC

In the discussion which followed, H. A. Fee of Adrian, John A. Cavanaugh of Benton Harbor, R. M. Hemphill of Detroit, D. H. Beardsley of Battle Creek, C. W. Johnson and B. R. Laraway of Jackson, and Mrs. E. L. Johnson of Frankfort took part.

Mr. Fee said his company keeps in touch with its public by having a man call on each customer at his premises to ask if "everything is all right" at least four times a year. "This practice," said he, "is one which we have tried, and can recommend as a plan that pays."

Mr. Cavanaugh said there is one man in the employ of the Benton Harbor-St. Joseph Railway & Light Company whose duty it is at all times to look at the customer's side of all questions. He is virtually an attorney for the consumers.

C. W. Johnson declared it should be part of a company's policy to hire high-class salesmen. Let the salesman—the man who meets customers—be a man who will give the customer the proper impression of the company's standing.

"A DAY WITH THE MANAGER"

In a paper entitled "Troubles," John A. Cavanaugh of Benton Harbor told in an entertaining conversational style the story of the ordinarily busy day in the life of a public utility manager, rehearsing the early morning telephone call to the manager's residence; the conferences with department heads, all of whom were asking for material—mostly copper—immediately; the manager's talk to his salesmen, and the personal call from a disgruntled alderman.

Those who discussed the paper were: James W. Bishop of Detroit, R. E. Keller of Kalamazoo, and George E. Lewis of Ann Arbor.

In a paper on "Merchandising Electric Appliances," written by David R. Thomas of the Michigan Power Company and read by C. W. Johnson of Jackson, the author declared that few central stations are to-day successfully merchandising electrical appliances. He classified the essential features of successful merchandising as follows: Service to the customer, incentive for the salesmen, intensive cultivation of territory, survey of the field, the financing of customers' purchases, and the maintenance of customers' appliances. He discussed each essential separately.

The discussion of the paper, which was replete with ideas, was entered into by R. W. Hemphill of Detroit, H. H. Crowell and C. W. Johnson of Jackson, J. E. Stanton of Belding, and H. A. Fee of Adrian.

PUBLIC POLICY AND STREET LIGHTING

A. C. Marshall's paper on "Street Lighting Service by Municipally Owned Plants," read by Herbert Silvester of Rochester, Mich., pointed out the interesting fact that if 1893 is assumed as the date of the beginning of the movement favoring municipal ownership of street lighting plants, and a curve is plotted showing their increase by years, the graph will be almost a straight line until about 1912, after which it begins to droop. It is possible that this droop began to appear about 1909—due to the building of high-tension networks by which small towns could be served without the high investment individual plants entail. This movement, continued the author, has already resulted in the sale of some of these village plants to large interconnected operating companies. While the movement has been partly offset by the establishment of small plants in parts of the country not yet covered by transmission lines, the tendency is definitely started and is responsible for the droop in the curve.

After reviewing data to show that when all costs are considered municipal street lighting service is no cheaper than that supplied by privately owned companies, Mr. Marshall suggested that since street lighting grievances, either real or fancied, have been the cause for starting many municipal plants, it might be well to take this business on a narrow margin of profit.

The paper was discussed by H. A. Fee of Adrian, R. E. Keller of Kalamazoo, John Cavanaugh of Benton Harbor, R. W. Hemphill and C. W. Johnson of Jackson, and H. H. Crowell of Jackson.

Mr. Crowell said it was his personal opinion that all street lighting business should be done by privately-owned companies and charged for at cost. Mr. Cavanaugh said that his company in purchasing its present plant had inherited a street lighting contract taken at a very low figure. He added, however, that perhaps it was not bad policy to take street lighting at low prices. He based his opinion on the fact that a municipal ownership agitation in his city had been quieted recently by writing the city clerk a letter and offering the company's street lighting system to the city gratis, and also offering to sell the city energy to operate the system at a lower price than it could generate the energy for.

VOLTAGE STANDARDIZATION

In a paper on "Voltage Standardization," written by M. D. Cooper and read by J. R. Colville of the National Lamp Works of the General Electric Company, Cleveland, Ohio, it was suggested that central station companies endeavor to standardize on three socket voltages, namely, 110, 115, and 120 volts, so that economies in the manufacture, distribution and utilization of lamps may be made.

After the discussion, which seemed to show that most of the operators present are tending toward the adoption of one of the three potentials, a committee on voltage standardization was appointed with members as follows: R. E. Keller of Kalamazoo, W. B. Thompson of Detroit, and J. A. Cavanaugh of Benton Harbor.

WHAT THE LAW SAYS ON TREE TRIMMING

"The Right of Public Utilities in Michigan to Trim Trees Growing in the Public Highways" was the title of a paper prepared by J. V. Oxtoby of Detroit and read by Herbert Silvester of Rochester, Mich. The paper was a legal brief which thoroughly covered laws and court decisions on tree trimming in Michigan.

The discussion brought out the fact that fewer con-

troversies over tree trimming and more satisfactorily trimmed trees are found in cities employing city foresters or other competent tree-trimming men. At Benton Harbor lines are often supported on span wires over the streets to avoid trees.

During an open discussion on electric ranges it developed that there is still some difference of opinion among Michigan operators as to whether or not the electric range load is an off-peak load. Those who have had the most experience with electric cooking all declared that this load is off-peak in character, but the executives of companies which have not yet started to sell ranges seemed to fear some baneful effect from the cooking load.

Inviting the Public to the Showroom—The Liberal Offer of the Louisville Company to Churches

The following letter has been sent to a thousand or more Louisville (Ky.) ministers, charity organization officials, heads of hospitals, benevolent clubs, etc., by Robert Montgomery, commercial manager of the Louisville Gas & Electric Company:

At frequent intervals churches and religious societies have bazaars, candy sales and other affairs of this kind, and it is usually difficult to secure a suitable store room or hall in which to hold them. In addition there is always the annoyance of having installed suitable electrical appliances, having the gas and electric services connected, cleaning and arranging of the place, etc.

Donald McDonald, general manager of our company, has instructed me to extend an invitation to all churches and religious and charitable organizations to conduct such affairs in our office at 311 West Chestnut Street, which is centrally located and excellently arranged for such purposes. We require only about one-half of the floor space, and therefore the entire east portion of the room on the ground floor will be at your disposal.

Sufficient notice should be given to avoid conflict of dates and to allow us to suitably rearrange the place.

We will have installed a gas range or any gas or electric appliance desired, and will put one of our porters at your disposal without any charge whatever.

As many of our customers remit to us by mail they seldom come to our office. Therefore we will be glad of the opportunity to become better acquainted with them. If you will extend this invitation to the organization you are associated with, I assure you it will be greatly appreciated.

Individual House Pumping "Prospects" That Might Be Overlooked

That a town which has a municipal waterworks can also be a fair field for the sale of individual motor-operated water pumping plants may seem paradoxical. But such a condition does exist at Aledo, Ill. The majority of people who have bought pumps there live just beyond the ends of the city water mains. Rather than go to the trouble and expense of getting the mains extended to their property, they have bought motor-driven pumps, put reservoirs in the upper parts of their homes, and now operate their own water-supply systems. The fact that their neighbors had "waterworks" service created the demand for such service outside the limits of the town system. Then the people were shown the logic of the electric-pumping plan by the officials of the Tri-County Light & Power Company. Besides advancing the fact that the electric way of getting water service was easier and less expensive, the central station men also showed prospective customers the advantages of taking pure water from their own mains instead of securing "just water" from city mains. After the first few pumps were sold, the rest of the twenty-four outfits now on the company's lines practically sold themselves.

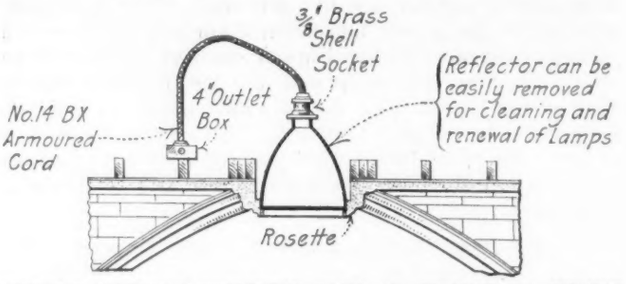
Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

Concealed Lighting that Emphasizes Architectural Features of Cathedral Interior

BY J. L. STAIR

A striking example of lighting from concealed sources is shown in the accompanying illustration of the St. Helena Cathedral, Helena, Mont. The impressive lighting effects which are obtained in this edifice are secured by a system combining direct lighting and indirect lighting.


3/8" Brass Shell Socket
4" Outlet Box
No.14 BX Armoured Cord
Reflector can be easily removed for cleaning and renewal of lamps
Rosette

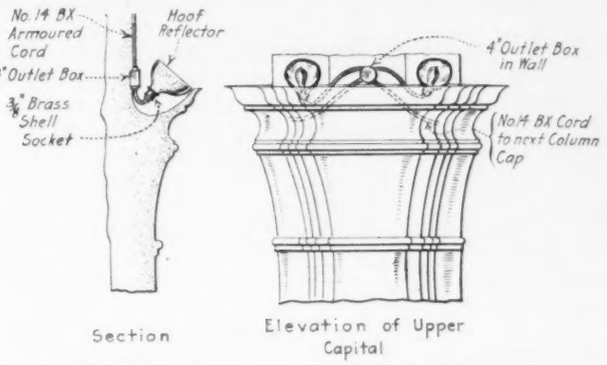
SECTION THROUGH REFLECTOR UNIT AT SUMMIT OF CEILING ARCH

The direct lighting units were placed in the ceiling of the nave, sanctuary, and side aisles, in such a manner that they can be easily removed into the attic space for cleaning and renewal of lamps. The ceiling units

CONCEALED ILLUMINATION OF CEILING ARCHES IN THE ST. HELENA CATHEDRAL, ST. HELENA, MONT.

consist of bee-hive type reflectors with 250-watt tungsten lamps. Connections were made to the conduit lines by means of No. 14 BX armored cord.

In order to bring out the architectural beauty of the interior, and also to provide indirect illumination, reflector units were imbedded in the lower and upper caps of the columns. After the units were in place they were carefully adjusted at the proper angles to give a


No. 14 BX Armoured Cord
4" Outlet Box
3/8" Brass Shell Socket
Hood Reflector
4" Outlet Box in Wall
No. 14 BX Cord to next Column Cap
Section
Elevation of Upper Capital

METHOD OF MOUNTING THE CONCEALED LAMPS

uniform spread of light over the interior surface. The electrical contractor carried the wiring circuits from one column cap to another in flexible conduit, following the arches between the columns. At each column the circuit branched off to each individual reflector. Four units were used at the lower column caps and two units at the upper caps. The hood type reflector with 60-watt tungsten lamps tipped at an angle of about 45 deg. is used for the upper units, while "Midget" type reflectors with 25-watt tubular tungsten lamps were employed for the lower units.

An idea of the general proportions of the interior may be gained by noting that the nave is 32 ft. wide and 68 ft. long, with a ceiling height of 56 ft. The sanctuary is 60 ft. by 47 ft. The side aisles are each 14 ft. wide, and the ceiling height is 28 ft.

From the standpoint of energy consumption, this is a comparatively economical installation. The power required totals 1.08 watts per square foot, this total being made up of 0.57 watt per square foot for the direct lighting and 0.51 watt per square foot for the indirect units. The estimated average illumination with all of the lamps in operation is 3 foot-candles.

The architect for the building was A. O. Von Herbulis, Birmingham, Ala. The details of the lighting were worked out by the engineering department of the National X-Ray Reflector Company, Chicago. The Steinmetz Electric Company, Chicago, was the electrical contractor who installed the equipment.

Cost Data for Two Styles of Street Lighting Standards Used at Riverside, Cal.

Two types of street lighting standards have been adopted in Riverside, Cal., one for the business district, carrying three lamps per standard, and another for the residence districts, surmounted by a single lamp and globe. In the business district the standards are placed on both sides of the street directly opposite each other, thus giving eight standards at intersections. In the residence district the standards are staggered, and so placed that only four are provided at each crossing.

The standard used downtown and on the main highways throughout the city was required to be of an artistic design, suggestive of the old Mission style, and the three-lamp concrete post shown in Fig. 1 was finally selected. This standard has a total height of 12 ft., is

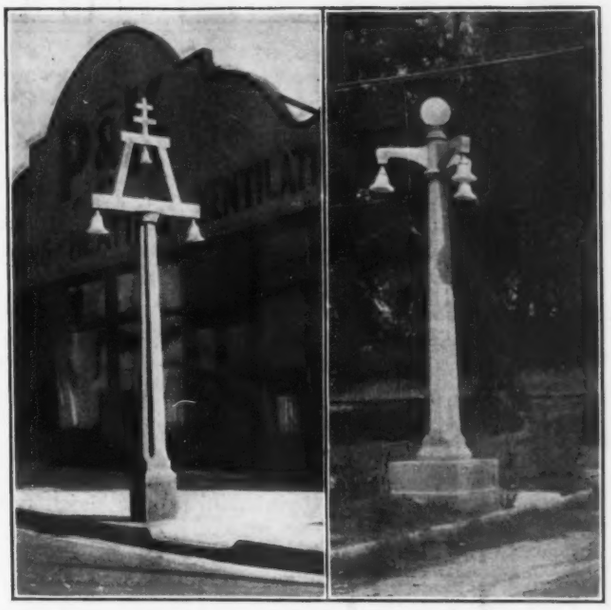


FIG. 1—THE THREE-LAMP MISSION POST USED IN BUSINESS DISTRICT. FIG. 2—A SPECIAL FORM OF FOUR-LAMP STANDARD AT CERTAIN STREET INTERSECTIONS

equipped with two 60-watt lamps and one 40-watt unit, and costs $40 per standard, equipped and in place. The cost for the lighting system using this standard varied from 80 cents to $1 per front foot, according to the spacing, which was usually about 180 ft. Of this type 389 standards have been put in service.

The single-lamp standard illustrated in Fig. 3 was selected for the residence districts, and 1244 have been installed. This stands 9 ft. 6 in. above ground, and is equipped with a single 60-watt tungsten lamp. The cost in large orders has been kept down to $14.50 per standard in place, equipped, and the cost for the system per front foot ranged from 33 cents to 50 cents with standards 200 ft. apart. The funds for installing the lighting system were raised by property assessments, so it was desirable not to lay out the locations in a way that would place an undue burden on corner lots. This was done by charging the poles set at intersections against the street on which the most lots fronted, and thus the assessment on "side streets" was kept low.

The distributing system in Riverside is owned by the municipality, which buys power from private companies.

FIG. 3—MORE THAN TWELVE HUNDRED OF THESE SINGLE-LAMP POSTS ARE INSTALLED IN THE RESIDENCE DISTRICT

ADVANCE IN TECHNICAL THEORY AND PRACTICE

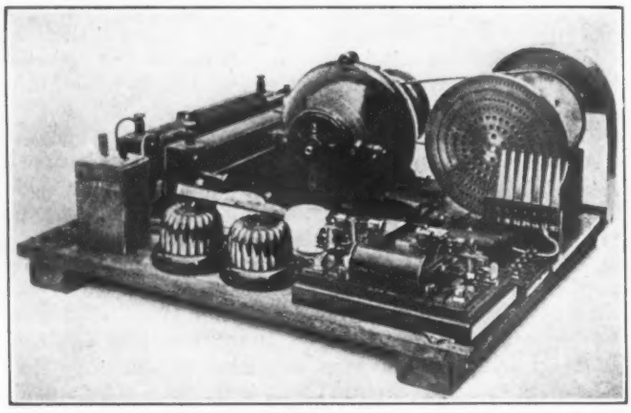
Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

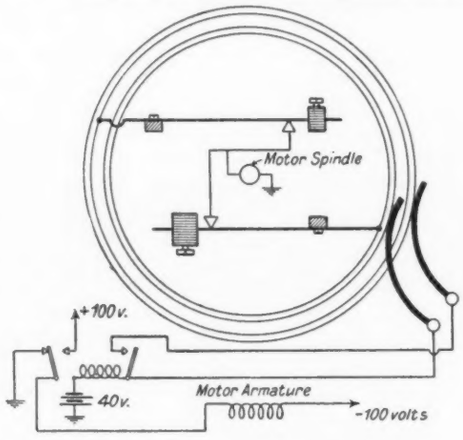
TELEPHONOMETRY

A Substitute for the Human Voice and the Human Ear in Telephone Transmission Line Tests and Transmitter Tests

IN an interesting paper read before the (British) Institution of Post Office Electrical Engineers, B. S. Cohen discusses the best methods of standard cable measurements and transmission testing. The installment of this paper published in London *Electrician* for June 2, 1916, deals with one of the most interesting problems in this field, that is, the problem of developing a substitute for the human voice and the human ear, and thus becoming independent of the personal element in telephone tests.

With respect to the substitute for the human voice, early experiments had indicated that a wave representing the fundamental and the sixth harmonic would give results approximating speech. This, however, was found only to be correct when used for comparing types of lines and circuits where relative results are not much affected by frequency changes. When the matter was reopened it was considered that the problem could be better tackled by experimenting with a wave containing the majority of frequencies of telephonic importance rather than attempting to use a wave containing only a few frequencies. As a result of considerable research the following arrangement was devised:





FIGS. 1 AND 2—APPARATUS FOR RHYTHMICALLY VARYING FREQUENCY AND DETAILS OF INTERRUPTER

An interrupter is varied in speed at a regular rate so as to go through a complete cycle of frequency from 700 to 1400 cycles and back again in the space of 0.7 second. This is attained by driving the interrupter from a motor which has attached to its shaft a centrifugal governor, which cuts in and out extra voltage on the armature. Fig. 2 illustrates the arrangement. A disk on the motor shaft carries two weighted contact springs connected to slip rings. One spring is lightly and the other heavily weighted, and they rest normally on a pair of contacts connected to earth through the motor spindle. The springs are connected through the slip rings to a relay and thence to earth, and the motor armature, to 100 or 200 volts, according to the relay position.

At low speed both springs are connected to earth, the relay is energized and the armature gets 200 volts. The speed increases and the heavy-weighted spring flies off its contact first, but nothing happens until the light-weighted spring breaks from earth at the top frequency of the interrupter. Then the relay is released, and as the armature is only on 100 volts the motor drops in speed. Directly the drop occurs the light-weighted spring earths again, but the relay is not affected until the heavy-weighted spring earths, when the cycle is repeated. The field of the motor has a potential difference of 200 volts across it continuously.

Fig. 1 shows the complete arrangement with motor, governor, interrupter and relay. The interrupter can supply at any speed a series of seven frequencies simultaneously. In practice the square wave from one set of studs only is used. This apparatus, which is termed a rhythmic interrupter, supplies a wave, rhythmically varied in frequency, to a non-resonating receiver. This consists of a modified electromagnetic receiver with a special diaphragm carrying a damping spring. The receiver is so adjusted that no resonance points occur between 700 and 1400 periods, *i.e.*, the range of the interrupter. It has been found possible to use a receiver which has one resonance point in the before-mentioned range by applying a wave smoother to the circuit. Such a receiver connected to the rhythmic interrupter described takes the place of the human voice.

The second problem was to find a substitute for the human ear. This measuring apparatus must be sensitive enough to give a good reading at the end of a long length of standard cable approaching the commercial limit and at the same time should be so ballistic as to give a steady deflection when actuated by the comparatively slowly-pulsating rhythmic current.

The arrangement adopted consists of a sensitive Sullivan-d'Arsonval galvanometer connected through its shunt to a carborundum-steel rectifier. This rectifier is at the center of one winding of a balanced 1 to 1 transformer. The other winding is connected through one or more audion gas-discharge relays, and thence to the high winding of a 1 to 5 step-up coil. The low side of the latter is connected to the receiving end of the standard cable. This apparatus gives a steady deflection when the rhythmically varying receiver is sounding into

a transmitter under test, and is also extremely sensitive. With a scale distance of 5 ft. 6 in. a current of 20 micro-amp. gives about 14 in. deflection. In making actual telephonic tests an equal deflection method is used, rendering calibration unnecessary. For example, assuming a test of transmitters, if the deflection with a standard transmitter through 35 M. S. C. is 50 cm., the cable length is varied when the circuit is changed over to the transmitter under test until the deflection is again 50 cm. The cable change equated to standard is then the standard cable value for the transmitter under test.

Test results show indeed that these substitutes for the human voice and ear are workable substitutes giving results in good accordance with tests in which the human voice and ear themselves are used. Table 1 gives results obtained in comparing various types of lines by standard cable measurement, telephonometer and calculation.

	Equated Length in M.S.C.		
Line Under Test	By Speech (Mean of a Number of Balances)	By Telephonometer (Single Test)	By Calculation from the Measured A.C. Constants
20-lb. artificial cable (No. 5), mica condensers, 20 mile virtual length.	21.4	21.2	21.2
400-lb. artificial aerial line, 200 miles virtual length, insulation resistance one per mile	6.7	6.4	6.3
The experimental 20-lb. cable, eight-pair multiple twin, 37 actual miles.	35.5	35.8	35.2
40-lb. artificial cable, 32 miles virtual length	26.1	26.25	26.2
70-lb. artificial cable, 32 miles virtual length	22.0	21.9	21.95

The agreement is very good, so that the telephonometer permitting a great saving of time should find extensive application in cable testing.

Generation, Transmission and Distribution

Steam Turbines.—H. G. STOTT and W. S. FINLAY, JR.—The full paper (abstracted before in this journal), which was presented before the American Society of Mechanical Engineers contained a detailed report on the efficiency tests of a 30,000-kw. cross-compound steam turbine, together with a full account of the discussion which followed. In this discussion H. G. Stott emphasizes the great progress made in the last fifteen years by the steam turbine. It has practically displaced the gas engine. The steam turbine's thermal efficiency has been brought up to about 25 per cent, so that it is practically in the same class as the best gas engine to-day, while the first cost of the turbine unit is seven or eight times smaller than that of the gas engine. The steam turbine can even compete with water-powers under many conditions. "Even take the case of Niagara Falls itself, where there is no dam required, and where there is practically an unlimited supply of power, the steam turbine plant can compete as long as the load factor is less than 60 per cent. The only chance for water-power development is on high load factor."—*Journ. Amer. Soc. Mech. Engrs.*, June, 1916.

Traction

British Railway Electrification.—In the conclusion of the long illustrated article on the Shildon-Newport Railway electrification the construction of the freight locomotives is described. They are designed to haul trains weighing 1400 tons at a speed of not less than 25 miles per hour on the level. The motor equipment of each locomotive consists of four totally-inclosed motors, each driving an axle through single-reduction twin gearing. The four motors are fitted two in each bogie, and are each wound for 750 volts, the pair of motors in each bogie being connected permanently in series. The four main motors of each locomotive thus form two units, which are controlled on the usual series-parallel system. Each motor is capable of developing 275 hp. at a speed of 20 miles for one hour with forced ventilation. The motor equipment is capable without injury of exerting a torque sufficient to skid the wheels under any conditions of rail, and will exert an average pull of 28,000 lb. at the tread of the wheels when starting under normal conditions of rail. The maximum pull at the tread of the wheels is, of course, considerably greater than this. The motors and gearing are designed so as to run at a speed of 45 miles per hour without exceeding the limits of safety, but the normal speed on the level when hauling a train of 1400 tons is 25 miles per hour. The equipment is so designed that each locomotive is capable of performing four round trips in twelve hours, each consisting of a trip from Shildon to Newport with a train of 1400 tons, followed by a trip from Newport to Shildon with a train of 800 tons, the distance of each trip being about 18 miles. The locomotives are able to start a train of 800 tons from rest on a grade of 1 in 100 and accelerate to normal running speed. The air supply for ventilating the motors is supplied from fans driven by the dynamotors.—London *Electrician*, June 9, 1916.

Units, Measurements and Instruments

Alternating-Current Method of Measuring Mutual Inductance.—HARVEY L. CURTIS.—An abstract of an American Physical Society paper. The mutual inductance between two coils is defined as the emf. induced in one when a current in the other changes at the rate of 1 amp. per second. If an alternating-current $i_1 = I_1 \sin \omega t$ flows in one coil then the induced emf. e_2 is given by the equation

$$e_2 = I_1 M \omega \cos \omega t \qquad (1)$$

provided that no current due either to leakage or capacity flows between the two coils or between the turns of either coil. If such currents do flow, then the secondary emf. e_2, measured at the terminals of the secondary with the secondary circuit open, may be represented by the equation

$$e = I_1 M_e \omega \cos \omega t + I_1 r \sin \omega t \qquad (2)$$

where M_e is the effective mutual inductance and r a small factor having the dimensions of a resistance. The open-circuit values of r and M_e may be measured by means of the set-up of Fig. 3. The detecting instrument G is a vibration galvanometer or telephone, depending upon the frequency of the alternating current

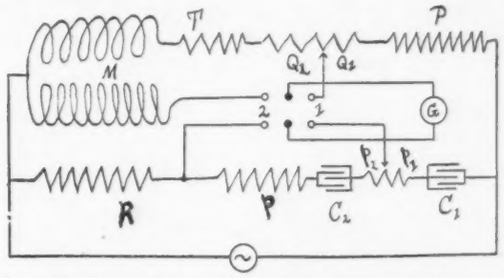


FIG. 3—APPARATUS FOR MEASURING MUTUAL INDUCTANCE

used. The inductance of the resistances R and P should be small and known. The resistances Q_1 and Q_2 are so designed that in varying Q_1, the sum $Q_1 + Q_2$ is always the same. This same condition also applies to p_1 and p_2; viz., $p_1 + p_2 =$ a constant. With the galvanometer switch in position 2, T and p are alternately adjusted until no current flows through the galvanometer. The balance can only be obtained provided the self-inductance in T is greater than M, so that it may be necessary to add inductance to this arm. The switch is then changed to position 1, and Q_1 and p_1 adjusted for zero current in the galvanometer. Then, neglecting small correction terms, $M_e = C_1 R (P + Q_1)$ and $r = \omega^2 C_1 p_1 M_e$. If

r is very small, it may be possible to make p_1 sufficiently small to obtain a balance. In such a case, a small inductance l is introduced in P. Then $r = \omega^2 C_1 (M_e p_1 - Rl)$ and M_e is unchanged. One of the advantages of the method is that the resistances R, P and Q_1, upon which the values of M_e depend, can be so constructed that the change of resistance with frequency and with temperature is a minimum. This in a measure compensates for the disadvantages of having to make four independent adjustments.—*Phys. Review*, June, 1916.

Miscellaneous

British Institution of Electrical Engineers.—A postal vote was recently taken of the members of the British Institution of Electrical Engineers on the proposed exclusion of alien enemies, and the details of the result were as follows: Cards issued, 3244; cards returned, 1470. In favor of (*a*) to expel members who are subjects of enemy-countries or states, 1320, against 88; in favor of (*b*) to expel members who, being naturalized British subjects, have retained enemy nationality, 1307, against 79; in favor of (*c*) not to expel members who are naturalized British subjects and were formerly subjects of a country or state now at war with Great Britain and Ireland, but who have under the laws of such country or state definitely lost their alien nationality, provided they are able to prove this to the complete satisfaction of the Council, 1081, against 264; in favor of (*d*) that no person shall after the ——— of —— 19—, be eligible for election as a member of the Institution who is a subject of any country or state with which the United Kingdom of Great Britain and Ireland is or shall have been at war on or after the date mentioned, 1120, against 200. At a meeting of the corporate members of the Institution held on May 25 the following resolution was carried by forty-one votes to one: "On and after the fifteenth day of June, 1916, no person, whether a naturalized British subject or not, who is or shall be or has or shall have even been a subject of a country or state, then or thereafter at war with His Majesty or his successors, shall be or continue to be or be eligible for election as a member of any class of the Institution, provided, nevertheless, that the above disability shall not apply to a person who, having at any time been a subject of such a country or state as aforesaid, shall have become and shall be a naturalized British subject, and shall prove to the satisfaction of the Council that under the laws of such country or state he has ceased to be and is not a subject thereof." A further special general meeting of the corporate members will be held to confirm this resolution.—London *Electrician*, June 2, 1916.

Electricity in Medicine.—F. FASSBENDER.—An article on methods of current regulation in the application of high-frequency currents for medicinal treatment.—*Elek. Zeit.*, March 9, 1916.

Book Reviews

LEÇONS SUR LE FUNCTIONNEMENT DES GROUPES ELECTROGÈNES EN RÉGIME TROUBLÉ. (A Treatise on the Operation of Dynamo-Electric Groups of Machines in the Unsteady State. By L. Barbillion. Paris, France: Gauthier-Villars & Company. 306 pages. 166 illustrations. Price 11 francs.

An excellent text-book on the principles governing the behavior of rotors when their steady state of rotation is disturbed. This is a very important dynamical subject which interests electrical engineers, especially those dealing with central station operation and design.

The author states in the preface, that the preparation of the manuscript was completed in June, 1914, but owing to the outbreak of the war, and his having immediately joined the ranks in that year, the publication has been delayed.

The work is divided into twelve chapters, dealing with the following topics: Torques, periodic and transient changes in rotor speeds, regulation and governors, dynamo speeds in the absence of governors, dynamo speeds under governor control, direct and indirect speed governing, the extent of speed changes in disturbances, damping of oscillations, practical control proportional to the deviation of speed, compensation mechanisms, influence of compensation on the character of perturbations, overcompensation.

The treatment employed is essentially mathematical, but the mathematics are those of the engineer rather than those of the physicist.

As a text-book on speed perturbations, this volume will have a recognized place. There is very little exact information available in engineering literature.

THE ENGINEER IN WAR. By P. S. Bond. New York: McGraw-Hill Book Company, Inc. 188 pages. Seventy illustrations. Price, $1.50.

Appearing at a time when members of engineering societies and students in technical colleges throughout the country are enrolling in military lecture courses and forming battalions for armory and field instruction in the duties of a soldier, this book will supply a widespread demand for information regarding the relation of engineering to the conduct of war and the adaptation of the principles of civil engineering to military requirements. The book is a revision and amplification of the series of articles entitled "National Defense—For Engineer and Contractor," which appeared recently in the Engineering Record. While intended primarily for engineers and contractors, the subject matter is of real value to every man contemplating military training, for with the paucity of engineer officers in the regular service any of the combatant forces might be called upon for engineering work in case of emergency.

Aside from its technical excellencies, Major Bond's work is characterized by a facility of expression rarely found in writings on technical subjects. He presents his facts in a convincing and interesting manner, and the book is easy to read. The fact that the manuscript, before publication, was submitted to and approved by the Secretary of War adds to its intrinsic value the weight of official sanction.

Major Bond's book is such an excellent and concise presentation of modern warfare's most important branch of operations that it should form part of the prescribed reading in every military engineering course inaugurated by American universities, and by national and local engineering organizations.

Books Received

POWER TRANSMISSION BY LEATHER BELTING. By Robert Thurston Peck. New York: John Wiley & Sons, Inc. 114 pages. Thirty-one illustrations. Price, $1.25.

EXPORTERS' ENCYCLOPEDIA FOR 1916. Containing full and authentic information relative to shipments for every country in the world. New York: Exporters' Encyclopedia Company. 1178 pages. Price, $7.50.

SPICES: Their Botanical Origin, Their Chemical Composition, Their Commercial Use. Seeds, herbs, leaves, etc., and miscellaneous technical advices and tables. St. Louis: Joseph K. Jank.

C. M. Bange has been appointed superintendent of distribution for the Edmira (N. Y.) Water, Light & Railway Company.

James T. Lynn of Detroit, Mich., has been appointed president of the Public Lighting Commission of Detroit, succeeding Charles H. Bryan.

Walter N. Walmsley has been appointed general manager of the Alabama Power Company, to succeed F. H. Chamberlain, who recently resigned.

Robert Montgomery, commercial manager of the Louisville Gas & Electric Company, has been elected temporary president of the Kentucky Ad Club, of which body he has been one of the chief organizers.

Walter F. Wells, who was elected first vice-president of the National Electric Light Association at the time of the recent Chicago convention, is vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn. Mr. Wells was born at Rahway, N. J., in 1870, and received his technical education at Rutgers College. After leaving school, he became associated with the Brooklyn Edison company, occupying successively, the positions of draftsman, foreman, and assistant electrician, and in June, 1894, was appointed electrical superintendent. In April, 1897; he accepted the position of assistant general manager of the then Manhattan Electric Light Company, with full charge of its technical departments. In 1900 this company was merged with the New York Edison Company and Mr. Wells was made district superintendent. During 1899 he also acted as superintendent of the old Mount Morris Electric Light Company. When the New York Edison Company made its first installation of rotary converters for 6600-volt transmission, the direction of this pioneer work was assigned to Mr. Wells. He also cooperated in the preparation of the plans and superintended the installation of the electrical plant of Waterside Station, No. 1, later being placed in general charge of the operation of this new plant. Upon the death of E. A. Leslie, vice-president and general manafier of the Brooklyn Edison company, the position of general superintendent was created and Mr. Wells was appointed.

W. F. WELLS

Men of the Industry

Changes in Personnel and Position— Biographical Notes

M. L. Hibbard, general manager of the Union Light, Heat & Power Company at Fargo, N. D., has been elected second vice-president of the Fargo Commercial Club.

J. F. Putnam, who was formerly professor of physics in St. Johns College, Shanghai, China, has been appointed assistant professor of electrical engineering in Sibley College, Cornell University, Ithaca, N. Y.

Robert E. Hughes, former president of the Kentucky Electric Company of Louisville, Ky., is chairman of the campaign committee of the Louisville Industrial Foundation, which is now endeavoring to raise $1,000,000 to be used in bringing new industrial enterprises to Louisville. Donald McDonald, the vice-president and general manager of the Louisville Gas & Electric Company, which succeeded the Kentucky Electric Company, is a leading member of the same committee.

H. S. Wilson has resigned his connection with the New England Engineering Company of Waterbury, Conn., where for the last nine years he has been engineer and manager of the power equipment department. Although Mr. Wilson is leaving the electrical field for other business he plans to remain in Waterbury. Mr. Wilson was early engaged in standardization work in connection with railway motors and controllers, and in 1894 he started up and operated one of the first electrically driven cotton mills ever built. In 1897 he served as electrical engineer in the layout of electrical properties in Mexico and in Chile. Later he was connected with the Submarine Signal Company of Boston, in the construction of a device for transmitting messages through water from submarines, and also designed the submarine-bell equipment of several lighthouses.

E. J. Burdick has been appointed assistant general manager of the Detroit United Railway, according to an announcement just made by F. W. Franks, president of the company. Mr. Burdick has been engaged in operating work with the company and its predecessors for the past thirty years. He was connected with the Westinghouse Electric & Manufacturing Company until May, 1895, when he left to take charge of the electrical apparatus of the Detroit (Mich.) Electric Railway. On the consolidation of all the properties now comprising the Detroit United Lines, Mr. Burdick was placed in charge of the power and overhead departments, where he has served up to the present time. He is past-president of the Detroit Engineering Society and has served the American and the Central Electric Railway Associations in many capacities.

W. D. Hart, who has been made general superintendent of the Tri-County Light & Power Company of Aledo, and who succeeds the company's retiring general manager, Adolf M. Barron, was formerly power engineer for the Illinois Northern Utilities Company of Dixon, Ill.

George E. Emmons, who has been plant manager of the General Electric Company at Schenectady, N. Y., for twenty years, was recently elected a vice-president of the company. Mr. Emmons began his electrical work with the old Thomson-Houston Company thirty years ago, and in 1894 joined the staff of the General Electric Company. In 1895 he was made general manager of the local plant, and has held that position since. In July, 1913, Mr. Emmons was appointed chairman of the company's committee on manufacturing.

W. I. Sturtevant has been appointed general superintendent of the Beaumont (Tex.) Electric Light & Power Company, one of the southwestern group of properties owned by the Stone & Webster interests. Mr. Sturtevant has been connected with the latter organization for the past three years, most of this time having been spent in Dallas. His new position is a recently created office and does not affect the associated organizations of the Beaumont Traction Company or the Jefferson County Traction Company, which will remain, as in the past, under the direct supervision of W. V. Neal, general superintendent.

Obituary

Edward A. McCoy, who was only recently appointed chairman of the lighting-fixture section of the Associated Manufacturers of Electrical Supplies, died at his home in East Orange, N. J., on June 24, following a six weeks' illness. Mr. McCoy was forty-five years old and was head of the firm of J. B. McCoy & Son of New York City, electrical fixture manufacturers, and president of the Lighting and Fixture Association of New York. Mr. McCoy was formerly well known as an amateur oarsman, having participated in many championship races. A widow and two children survive him.

E. A. MC COY

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Combination Gas and Electric Ranges

The automatic time switch for turning on the current and automatic thermostat to cut it off continue to be features of a new line of electric ranges developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., while three-heat control for each heater in the ovens as well as on the stove top has been added. The most important of the new ranges are those furnished with gas burners on top and electric ovens, this combination being particularly adapted to localities where the cost of energy is high and, therefore, stove-top heating, which requires continuous application of heat, is rather expensive with electricity. The fireless cooker principle used for the ovens in connection with the thermostat cut-off, it is pointed out, makes the ovens very economical to operate.

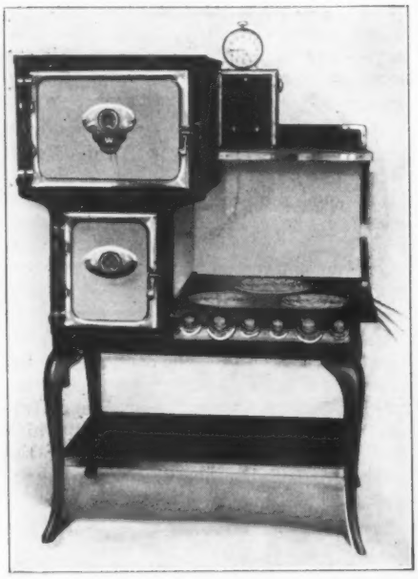


FIG. 1—ELECTRIC RANGE WITH ELEVATED OVEN

All parts of the range are of metal, and while they are so constructed that parts cannot work loose, every part is quickly accessible for thorough cleaning and repairs can be made quickly. The manufacturer claims that these are the only ranges approved by the National Board of Fire Underwriters.

Meals can be cooked automatically on these ranges, that is, the housewife can put the food in the oven at any time of the day and set the clock for automatic starting at the proper hour, at the same time setting the thermostat to cut off at the proper temperature. Baking, roasting and boiling can be done in this way. When the proper temperature is reached, which requires ten minutes to half an hour, depending on the temperature required, the current is automatically cut off and from then on cooking proceeds as in a fireless cooker. The heavy heat insulation about the walls of the oven—2 in. of rock wool—causes the ovens to retain their heat for hours. Not only does this feature make the ranges convenient for the user, but makes a desirable load for the central station, inasmuch as the peak of the range load comes an hour and a half to two hours before meal time.

Cooking processes that do not require much time and for which the food cannot be prepared in advance, are performed on the stove top. For this purpose the electric ranges have two 8-in. and one 10-in. radiant heaters, each having a special three-heat indicating control switch. In the combination gas and electric ranges the stove top is provided with four gas burners, one of which is of extra large size with a small, especially controlled, simmering burner in the center. All the burners can be lighted instantly by means of an automatic gas lighter controlled by a valve at the front of the stove which normally burns a very small pilot flame.

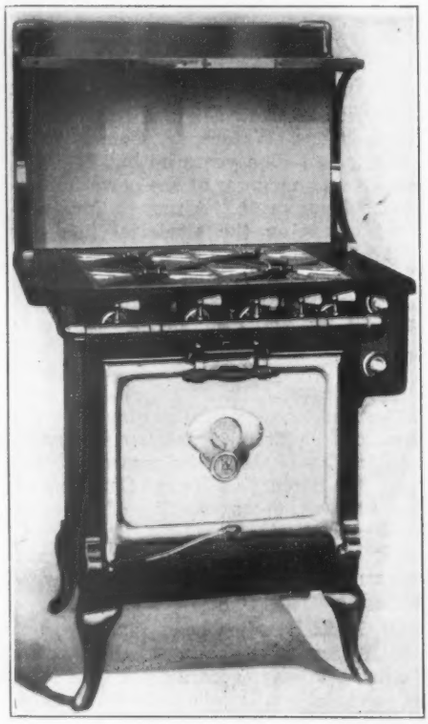


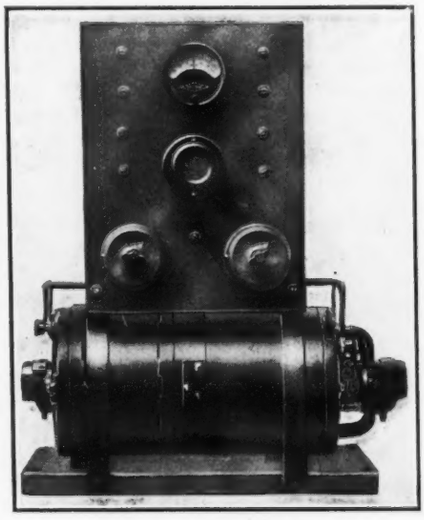
FIG. 2—COMBINATION GAS AND ELECTRIC RANGE

It is claimed that better cooking results can be obtained in the electric ovens than in those of a gas range owing to the fact that two heaters are provided, one at the top and the other at the bottom with baffle plates to provide a uniform distribution of heat. Pastry can be browned just as in any other kind of range. It is also claimed that food shrinks less in these electric ovens than in a gas oven, owing to the more flexible application of the heat and the fact that the oven is entirely inclosed except for a small ventilating pipe.

An important feature of Westinghouse electric ranges is the fact that they can be thoroughly scoured in every part. Everything, including the rack holders, can be removed from the ovens and the surface flushed with water without the slightest injury. There are no inaccessible places where dirt or grease can collect. About eighty-two styles and combinations of ranges are manufactured in these general models, some of the styles being illustrated herewith. The load varies between 2000 watts and 13,700 watts, depending on the size and style, and the load factor is said to be less than 50 per cent. As for operating expense, a large number of tests have demonstrated that the consumption of current averages between 75 and 100 kw.-hr. a month for the straight electric ranges.

Motor-Generator Charging Outfit

The Electric Specialty Company, Stamford, Conn., has recently developed a complete motor-generator set with panelboard for battery charging and signal work. The motor may be wound for either direct current or alternating current of any standard voltage and



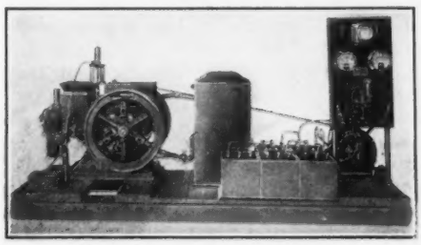
SELF-CONTAINED MOTOR-GENERATOR CHARGING SET

frequency; the generator may likewise be wound for any voltage desired. At present the outfit is being built in four sizes, with ratings of 100 watts, 180 watts, 280 watts and 350 watts. The generator frames are of cast steel, while the alternating-current motor frames are similar in design to the Electric Specialty Company's standard alternating-current motors, the laminated stator disks being clamped together with heavy cast-iron clamp rings, with no exterior casing about the stator iron. This feature, together with the large ventilating ducts and small fan, afford extra good ventilation at low temperature under continuous full-load run, it is pointed out. The equipment is provided with oil-ring bearings, although ball bearings may be supplied, if desired. The largest machine will charge five 6-volt batteries at one time, but the voltage may be reduced sufficiently to charge only one 6-bolt battery. The panelboard is of slate and contains a combination voltmeter and ammeter and two large snap switches mounted on the front of the board, with field regulator, motor fuse and battery terminals on the rear.

Small Lighting Outfit

The "Hawkeye Special" lighting plant shown herewith is rated at 750 watts, and has been developed by the Warner Lamp Company, Davenport, Iowa. The generator is connected to the engine by an endless belt 12 ft. long and 2 in. wide. The engine is lubricated by an electrically controlled oiler, which is placed in operation when the generator starts, and stops when the generator stops. The plant works at a normal pressure of 30 volts.

The switchboard is equipped with two main-line fuses, a voltmeter which may be utilized for indicating the voltage of the battery and generator combined or either the battery or generator separately, an ammeter with a "zero" center, which shows the rate of battery charge on one side and the rate of discharge on the other side and switches. The switch in the center of the board is an automatic device of new design used to control the main circuit between generator and battery and also the ignition circuit of the engine. It is also employed as an automatic end-cell switch, the manufacturer states, so that when an Edison battery is employed enough of the battery may be cut out and disconnected from the line while charging to prevent an abnormal voltage. With this automatic switch, the manufacturer further points out, there is no need of remembering either to close or open the end-cell switch, because it is impossible to start the plant without making the proper end-cell connection; likewise, it is impossible to stop the plant without making the proper end-cell connections.



750-WATT LIGHTING PLANT

The scale of the ampere-hour meter represents four-fifths of the capacity of the battery. At the charge side of the scale it is marked "full," and there is a contact pin which leads to the automatic switch magnet. At the other side of the scale is another insulated contact pin which may be connected to a signal bell, colored lamp, or any other means of sounding an alarm or giving a signal when the batteries are discharged as far as it is safe or advisable to discharge them. Provision has been made so that in case the lubricator should become empty, the crank bearing get warm, the ignition system go wrong, the belt break, or the gasoline supply become exhausted, the engine would be stopped and the battery disconnected from the generator. One of the main features of the plant, according to the manufacturer, is the electric governor, which is so sensitive that the full capacity of the plant in lamps can be turned off or on with less than 1 volt variation.

Traffic Posts

Because street traffic has become so hazardous in most cities that means must be provided to protect pedestrians and prevent collision of automobiles and other vehicles, the George Cutter Company of South Bend, Ind., has brought out a cast-iron traffic post or "silent watchman" to mark the centers of intersecting streets. The posts are made of gray cast iron and may be equipped with either ruby or white diffusing globes. They are fitted with medium or "Mogul" screw multiple sockets or series film sockets of the "Regent" and standard types.

FIG. 1—CAST-IRON TRAFFIC POST OR "SILENT WATCHMAN"

To install one of these silent watchmen, three bolts about 12 in. long and 0.75 in. in diameter are set into a concrete foundation. The bolts extend 2.5 in. above the surface of the concrete. The post is then set over the bolts which engage three lugs within the base. A door in the base is large enough to admit a wrench for tightening nuts on the bolts. Although connections are usually made from underground circuits, a cross-arm may be furnished to clamp directly beneath the globe holder should overhead connection be desirable.

FIG. 2—STREET SCENE WITH TRAFFIC POST

The dimensions of the post are as follows: Base, 14 in. in diameter, 24 in. high; column, 5 in. in diameter above the base, tapering to 3.5 in. in diameter near the top; height from base plane to bottom of globe, 6 ft. The ruby globes are 6 in. by 12 in. in size.

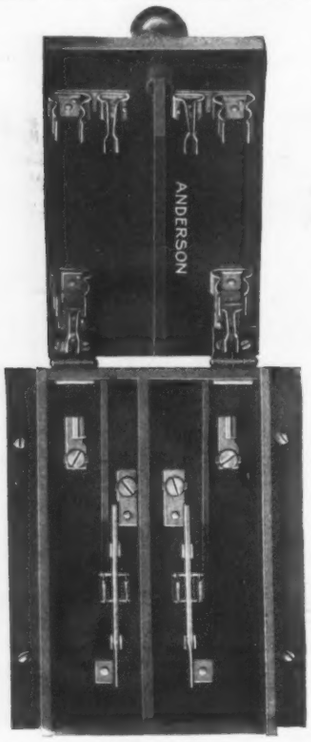
Inclosed Direct-Current Switch

The "Anderson-Elcon" switch, as it is called, shown herewith, is an inclosed fused switch, so constructed that when opened the fuse terminals are disconnected from the live metal parts, and are exposed in such a way as to render them most accessible for the examination or replacement of fuses. In handling fuses on circuits of pressures higher than 110 volts, it is very desirable that the circuits containing the fuses be "killed" prior to such handling. On 250-volt circuits this result is often obtained by attaching the fuses to the cover of the fuse box in such a way that they are automatically pulled from the fuse clips when the box is opened. This is not possible on high-voltage circuits, however, it is pointed out, owing to the fact that a quick break of some nature must be provided, if, as is often the case, the circuit is to be opened prior to the handling of the fuses.

The switch shown is so constructed that upon opening the box the circuit is opened by means of suitable quick-break switch blades, and when the box is open the fuses are exposed to view on the cover, and are disconnected from all live parts so that they may be handled without danger of touching any live metal. The action of the quick-break switch blades is said to be positive and reliable, and, as the fuse clips are not connected with the circuits when the switch box is open, the fuses

may be examined or replaced by a workman inexperienced in the handling of electric circuits.

Owing to the danger of a high-potential direct current jumping to metal parts of switch boxes, when such parts are used, the boxes of the switches of



INCLOSED DOUBLE-POLE DIRECT-CURRENT SWITCH

the type illustrated are made entirely of insulating material. Except such parts as fastening screws, clips and hinges, no material is used except impregnated asbestos lumber, fiber and alberene stone. By suitably proportioning the parts made of the above materials the switch boxes combine the ruggedness necessary to withstand the rough handling usually met with in the use of switches of this nature, it is declared, with perfect protection against the possibility of short-circuits, or grounding of wires caused by the use of metal boxes, as mentioned above.

The switches are made in both single-pole and double-pole units for direct-current operation at pressures of 600 volts, 1200 volts and 2400 volts. The single-pole switch is used principally on grounded circuits. While the switches were designed particularly for controlling air-compressor motors on electric surface cars, they are also adapted for general use where fused switches are desired on high-voltage direct-current circuits. The switch is being placed on the market by the Albert & J. M. Anderson Manufacturing Company, 289 A Street, Boston, Mass.

Small Direct-Current Motors

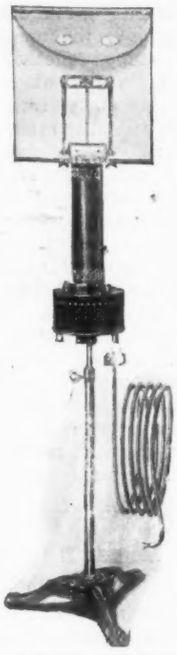
To meet the demand for direct-current motors of the smaller ratings for direct connection and the drive of various kinds of industrial machinery, machine tools, etc., the C & C Electric and Manufacturing Company of Garwood, N. J., has developed a new line of motors of the type shown herewith. The motors, which are known as the Type IB machines, are of the bi-polar type with interpoles and can be furnished in ratings up to 10 hp. in either the shunt-wound or compound-wound models. For the drive of machine tools and other industrial machinery, the characteristics of the shunt-wound motor are the most desirable, it is pointed out. The shunt-wound motor is essentially a constant-speed machine, having close speed regulation from no load to full load, and is especially designed for all purposes where the torque required for starting and accelerating does not greatly exceed full load torque. The compound-wound motor is desirable for drives, it is stated, where the starting torque is much heavier than the full-load torque. This motor starts at a much heavier load than the shunt-wound motor, and any degree of compounding can be furnished to meet varying conditions. Adjustment of the speed is obtained in both cases by either armature or field control.

The main frame with supporting feet is cast integral, and the pole pieces are separate. The main-pole pieces and pole shoes are laminated, and the interpole pieces are separately cast and the coils are all form wound. The pulley-side bearing bracket is provided with a wide apron to protect the winding from mechanical injury, and the bearing, supported by four arms with large openings between them, makes a rigid open bracket, permitting free and ample ventilation. The commutator side bearing bracket has four arms, giving a rigid bracket and free access to the commutator and brushes. Both brackets fit in a recess in the main frame, insuring perfect and rigid alignment, it is asserted. An air agitating fan is placed on the pulley side of the shaft, next to the armature winding. In continuous operation for long periods, the machines run cool and without attention, it is claimed, and the interpoles insure sparkless commutation through the full range of load without changing the brush position. The motors are furnished in the open type, or with perforated or totally inclosing covers for protection against dust, metal chips, dampness, etc. For belt drive the motors can also be furnished with either a "universal" slide-rail base or a belt-tightener idler pulley.

DIRECT-CURRENT MOTOR

Twin-Arc Lamp for Motion-Picture Purposes

A portable lighting unit designed for use in motion picture photography known as the "Kliegl Liliput" arc lamp has recently been placed on the market



PORTABLE MOTION-PICTURE LIGHTING UNIT

by the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York. According to the manufacturer it furnishes an evenly distributed, intense flood of white light of great actinic value, which is identical in quality to daylight. The lamp works equally well, it is pointed out, on direct current or alternating current, at pressures ranging from 110 volts to 125 volts. It is small and neat in appearance, and can be moved about readily to secure whatever lighting effects are desired. It is compact—rheostat, arc lamp and hood forming a complete unit, ready for use, which can be employed wherever electric current is available. The device is 33 in. high without the stand and 66 in. high with the stand and can be readily adjusted to any height desired. The weight with stand and 25 ft. of cable is 30 lbs. The device is equipped with two sets of carbons, with automatic feed, for use on either alternating current or direct current and takes 15 amp. at 110 volts. The carbon holders are inclosed in a sheet-metal hood of special design. A groove or slide is provided on the front of the reflector for a diffusing screen. A swinging joint is also provided for the top carbon holder, which permits the carbons to take the correct position the instant the circuit is closed. No operator is necessary to start the lamp or regulate the carbons, it is claimed, and all live parts are inclosed in the hood. The rheostat is fastened to the bottom of the lamp and acts as a base for the lamp to stand on when it is used without the adjustable stand. It is provided with a connector for disconnecting the cable from the lamp.

Socket with Porcelain Bushing

To meet the demand for a porcelain bushing that will serve as an insulating socket cap and strain-relief for the

SOCKET WITH PORCELAIN BUSHING

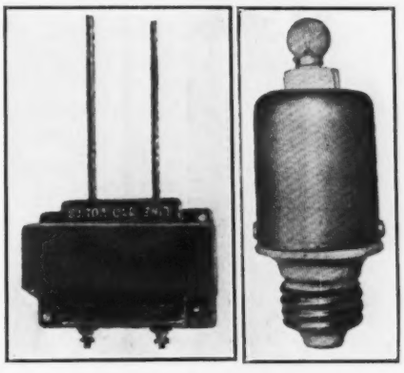
cord, Harvey Hubbell, Inc., Bridgeport, Conn., has recently brought out a line of standard sockets of the type shown herewith, equipped with bushings as illustrated. The sockets may be secured with either the Hubbell "Presturn" or "Quick Catch" shell fastening. The manner in which the bushing serves as a strain relief is shown in the illustration.

Turbine-Driven Exciter Sets

According to the manufacturer of the duplex turbine-operated exciter set shown herewith, the set combines all the advantages of the motor-driven set and the reliability of a steam-driven outfit. The set consists of an exciter-generator coupled to a motor at one end, and to a steam turbine at the other end. For normal operation, the set runs as a motor-generator outfit. Should the motor circuit be interrupted or anything happen to the motor itself, the speed will drop slightly, and the governor of the turbine will therefore immediately act and the machine from that time on run as a directly connected turbo-exciter set. The action of the special governor, it is claimed, is so sensitive that when the switch controlling the motor is pulled, the turbine will instantly take hold of the load without any appreciable fluctuation in voltage. The turbine governor is also fitted with a speed-changing device used during normal operation to divide the load between the turbine and the motor, so that the unit can be operated at its maximum efficiency at all times. With this device, as the station load increases and with it the demand for exhaust steam for the feed-water heater, the load can be gradually shifted from the motor end to the turbine end. The proportion of the load carried by the turbine can be varied at will, it is asserted, from 0 per cent to 100 per cent, in order to supply exactly the amount of exhaust steam needed to maintain the proper heat balance in the heater. The turbo-exciter set is being placed on the market by the Terry Steam Turbine Company, Hartford, Conn.

Low-Voltage Transformers

Bertrand F. Miller, Trenton, N. J., has brought out a line of what is called "Ajax" low-voltage transformers, three different types of which are shown herewith. The small "Lo-lite" transformer illustrated in Fig. 1 may be connected to any lighting socket. It is equipped with a miniature 1-cp. lamp and is designed especially for night-lighting purposes and for use in sick rooms where a low light is required. The device has a maximum energy con-



FIGS. 1 AND 2—TRANSFORMER FOR NIGHT LAMPS AND BELL TRANSFORMER

sumption of 2 watts. It operates on alternating current only at a pressure of 110 volts and frequencies of from 60 to 133 cycles. The miniature lamp operates at 3.8 volts and 0.35 amp.

In Fig. 2 is shown a bell transformer, the coils of which are form-wound, with enameled magnet wire, with insulating paper between each layer of wire. The case may be of cast-iron or aluminum as desired, and the leads are brought out through the walls in heavy insulating

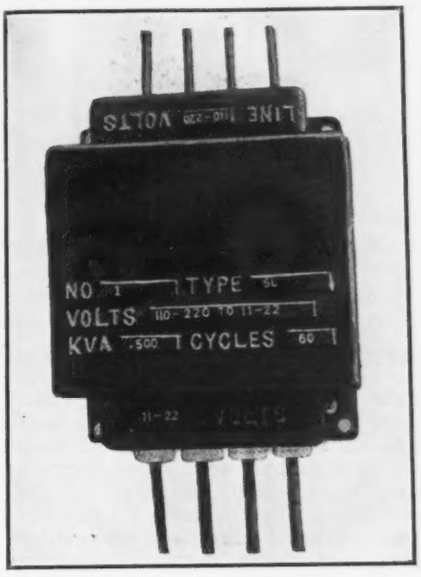
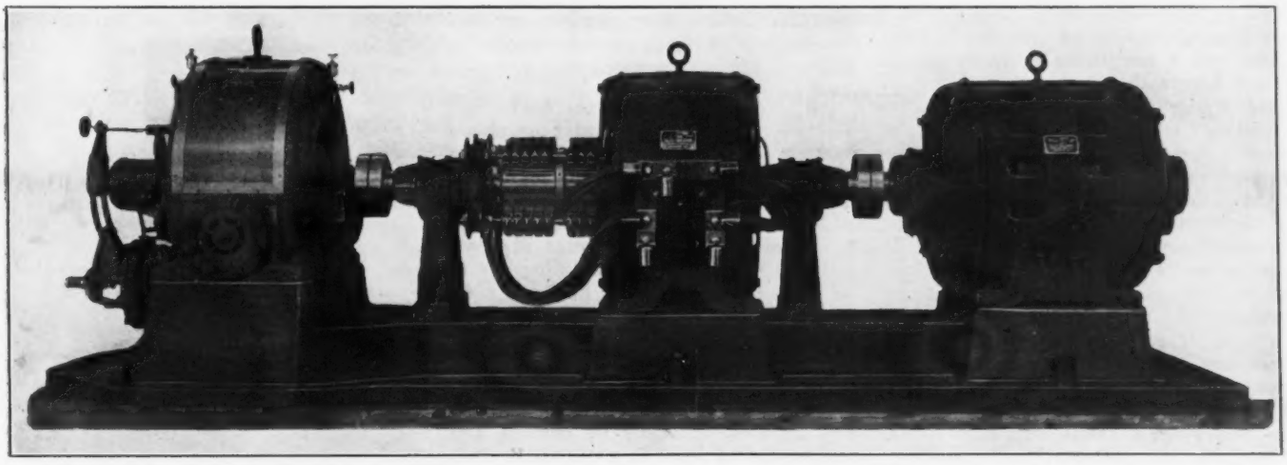


FIG. 3—SIGN TRANSFORMER

bushings. Transformers of the type shown are designed to withstand an insulation test of 2500 volts, alternating current, for five minutes between the primary and secondary coils, and 1000 volts, alternating current, for five minutes between the secondary coil and core. The transformers are being made in midget, 25-watt and 50-watt sizes. The smaller sizes of bell transformers may be short-circuited for long periods, the maker points out, without burning out or heating excessively.

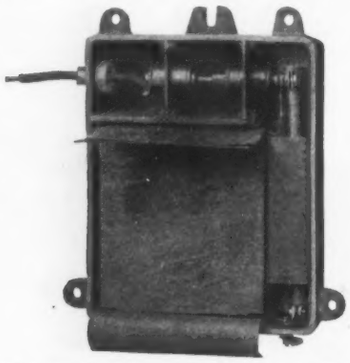
In Fig. 3 is shown a sign transformer, the leads of which are brought out so that they may be connected either to 110-volt or 220-volt circuits on the primary side and 11-volt or 22-volt circuits on the secondary side. The leads are brought through the walls in porcelain bushings. The sign transformers are made with ratings of ⅛ kva. to 2 kva., the weights of which vary from 10 lb. to 65 lb.



75-KW. TURBO-EXCITER SET

Lightning Arresters

Arresters of the type illustrated, designated as Type K-3 device and just placed on the market by the Westing-



DIRECT-CURRENT LIGHTNING ARRESTER

house Electric & Manufacturing Company, East Pittsburgh, Pa., have been designed for use at pressures of from 100 volts to 1500 volts direct current. They are especially adaptable for the protection of direct-current railway and power motors, direct-current generators, and rotary converters. When properly connected they are also of value in preventing flashovers on the commutators of rotary converters. They are furnished for car, pole or wall mounting.

The Type K-3 arresters are made in two forms, one consisting of a condenser with a spark gap in series with it and a high resistance in shunt with it, for car and station service, the other consisting of the condenser alone, without series gap or shunt resistance, for line mounting. The condenser is of the flat-plate form, of high electrostatic capacity and amply tested for breakdown voltage. For car mounting, the condenser is of 1 microfarad capacity, equivalent to the capacity of 100 miles of average line. For line mounting the capacity is 0.3 microfarad, equivalent to the capacity of 30 miles of average line. In the line mounting form, without gap or resistance, the condenser is connected direct to the line and ground terminals. In the forms that include gap and resistance, the line terminal is connected through an adjustable spark gap in a separate chamber. This gap is in series with the condenser, the ground lead being connected to the case, and a resistance is connected in shunt across the condenser, serving to keep it discharged to zero value. This resistance is so high that even with the spark gap closed only a negligible amount of direct-current energy can flow. The spark gap provides a means of noting the discharge of the arrester by placing a test paper in the gap. It can be easily adjusted and set so close as to just prevent line voltage from bridging it.

Both forms of these condenser-type arresters are mounted in a rectangular cast-iron box with waterproof cover. The spark-gap chamber is accessible by removing a small, separate cover. They are easily mounted underneath or on the roof of a car, and in any position on a car, pole or wall.

Induction-Type Water Heater

A method of converting electrical energy into heat by the induction principle has been applied by the Coin Machine Manufacturing Company, Portland, Ore., to water heating and to the operation of steam-heating plants and of melting pots for linotype and other type-casting machines. The water heater shown in Fig. 1 consists of a cast-iron core, through which passes the fluid to be heated; laminated U-shaped sections surrounding the ends of the core on two sides, and a circulating primary coil through which the exciting current passes, the whole being inclosed in a metal casing. The induction heater is practically indestructible, it is claimed, the primary coil being of such large-sized wire (about 1000 circ. mil. per ampere) that there is no danger of it burning out. Pure asbestos insulation is used throughout.

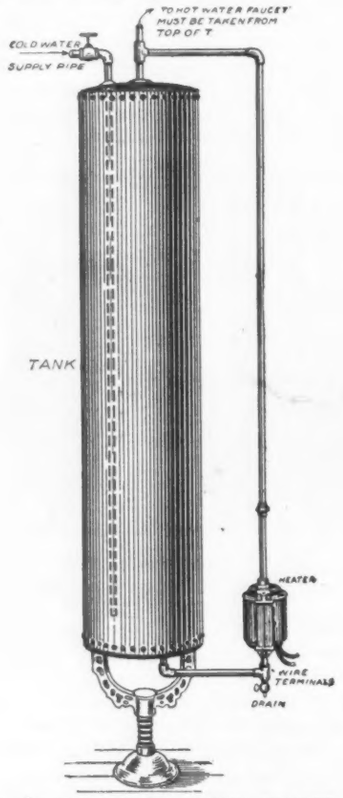


FIG. 1.—INDUCTION WATER HEATER ATTACHED TO ORDINARY RESIDENCE WATER TANK

As already mentioned, the heater can also be applied to hot-water or steam heating systems. Where the heating systems are already installed it is only necessary to connect the heater in place of the boiler. Where new plants are to be installed, or where rooms at some distance from the main building are to be heated, it is better to heat the radiators with individual heaters.

In Fig. 2 is shown a sectional view of an induction-type of melting pot for type-casting machines. According to the manufacturer, with this electric melting pot, accuracy of control and uniformity of heat is assured, so that maximum efficiency can be obtained. Fire risks and objectionable odors are eliminated, barely forty-five minutes is required for heating the metal ready for use. The automatic control keeps the metal at the proper temperature to in-

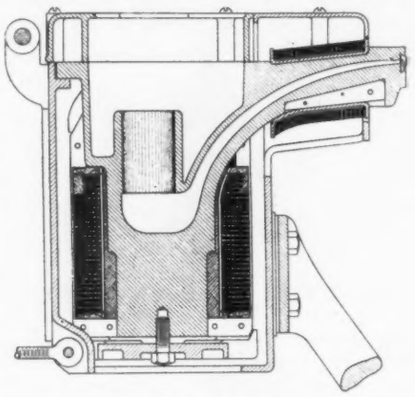
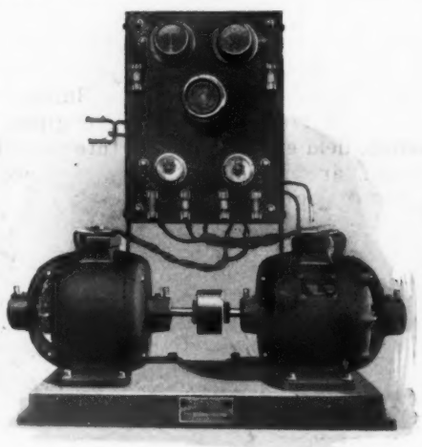


FIG. 2—ELECTRIC MELTING POT FOR TYPE-CASTING MACHINES

sure perfect type slugs without bother to the operator, or chance of porous or imperfect slugs.

Charging Set

In the accompanying illustration is shown a complete charging outfit, consisting of motor and generator directly connected by a flexible coupling and mounted on a cast-iron sub-base, which also carries a control panel with voltmeter, ammeter, rheostat, control switches and fuses for both motor and generator circuits. The coupling between the motor and generator may be disconnected by hand, leaving the motor free for driving air compressors or other small machines. The motor is of the induction-repulsion type and the Emerson generator employed is of the shunt type with the rising voltage characteristics necessary for charging storage batteries. Having a wide range of voltage, the generators are not only practical for charging sets of several different voltages, the manufacturer claims, but for charging at the low rate often necessary for equalizing and prolonging the life of the battery. The motor-generator is being made in five different sizes with ratings of from 60 watts to 500 watts. The set is being placed on the market by the Kewanee (Ill.) Private Utilities Company.



OUTFIT FOR CHARGING BATTERIES

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

ELECTRICAL MEN TO THE FRONT

Employers Show Patriotism by Granting Wages During Absence with Assurance of Position on Return

When the Nation's call for militiamen and guardsmen of the several states of the Union to guard the Mexican border and to be prepared for any emergency came, the electrical industry was found to be well represented. From all quarters of the country troops have been speeding to our southern border, a large percentage of whom were, when called out, engaged in electrical pursuits.

It is hard to estimate the number of electrical men who have entered the military service, but it is certain that the count will run up to many thousands. It is known that there went from the Westinghouse shops and offices in the neighborhood of 1000 men. Of the 350 who enlisted from Schenectady 239 were employed by the General Electric Company.

Most of the men who have answered the call to arms are, of course, the younger men whose individual loss will not be so keenly felt by the industry, but the loss of their time in the aggregate will undoubtedly make a serious impression. Men of greater responsibilities have also enlisted prominent among whom is Brig. Gen. E. W. Hine, secretary of the Public Service Corporation of New Jersey.

FORM ENGINEERS' CORPS

Immediately upon notice of the seriousness of the Mexican situation, J. W. Swaren of San Francisco, who has been taking an active interest in the Engineer Corps of California, conferred with officers of the regular army and decided to organize an engineer battalion to be associated with the National Guard of California. This is being organized in the expectation of active service.

Anticipating that with the new Federal law in operation on July 1, Illinois will be called on for more troops, a movement is under way to establish two more military engineer organizations to be known as Companies B and C of the First Battalion Engineers. These additional volunteer engineer companies will be offered to the State and Federal governments, Company A being now at the Springfield concentration camp. Applications for enrolment are being rapidly received by H. B. Sauerman, 1140 Monadnock Building.

E. B. Murray, a consulting engineer, and Paul McGeehan, field engineer of the Interstate Commerce Commission, are gathering Kansas engineers who wish to be counted upon for enlistment in a corps if a call comes for volunteers.

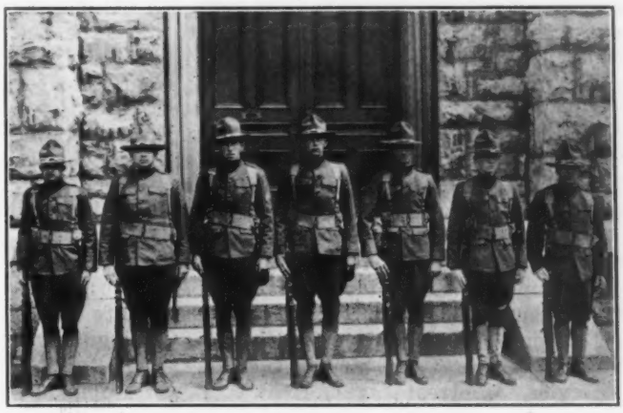
W. K. Parker, sales manager of the Wales Adding Machine Company at Kansas City, is promoting a volunteer movement for the organization of two complete battalions of signal corps, the first and most important feature of which is the securing of electrical engineers for officers. Among the men known in the electrical industry who are participating in the movement are W. J. Squire of the Squire Electric & Construction Company; O. B. Bourn, W. Richardson and F. Lyman, electrical engineers with the valuation division of the Interstate Commerce Commission.

EMPLOYERS GRANT WAGES

Fully as patriotic as their men have been the employers, central stations, management associations, manufacturers, contractors, jobbers and dealers. Not an instance has been brought to the attention of the ELECTRICAL WORLD where an electrical employer has attempted to place any obstacles, no matter how small, in the way of his men entering the service of this country. Wages are being paid during the term of service, and positions are being held open for the men upon their return.

From the large number of electrical interests who will furnish one or more men for military duty the following have been definitely brought to the attention of the ELECTRICAL WORLD:

Central stations—United Electric Light & Power Company, New York; Reading (Pa.) Transit & Light Company; Empire Gas & Electric Company, Auburn, N. Y.; Public Service Electric Company, Newark, N. J.; Buffalo (N. Y.) General Electric Company; Puget Sound Traction, Light & Power Company; New York & Queens Electric Light & Power Company, New York; Philadelphia (Pa.) Electric Company.



EMPLOYEES OF EMPIRE GAS & ELECTRIC COMPANY WHO HAVE JOINED THE NATIONAL GUARD

Holding companies—Hodenpyl, Hardy & Company; H. M. Byllesby & Company; Henry L. Doherty & Company.

Manufacturers—Thomas A. Edison Company; Electrose Manufacturing Company; Metropolitan Electric Manufacturing Company; National Conduit & Cable Company; Westinghouse Electric & Mfg. Company; General Electric Company; B-R Electric & Telephone Manufacturing Company.

Telephone and telegraph—American Telephone & Telegraph Company; Bell Telephone System; Western Union Telegraph Company; Marconi Wireless Telegraph Company.

Publishing—McGraw Publishing Company; publisher of ELECTRICAL WORLD, *Electric Railway Journal, Electrical Merchandising, Engineering Record and Metallurgical and Chemical Engineering.*

CONVENTION OF CANADIAN ELECTRICAL ASSOCIATION

Annual Meeting Held on Board Ship Well Attended by Members From All Sections of the Dominion

The annual meeting of the Canadian Electrical Association was held on the Steamship Toronto, Canada Steamship Lines, on June 21 and 22, and was very well attended. The arrangement made permitted the Western members to take the boat at Toronto and proceed thence to Prescott, where they were joined by representatives of the Eastern part of the country.

In the absence of Col. D. R. Street, the president, who had just left on active service in command of the 77th Battalion of Ottawa, the chair was taken by D. H. McDougall, vice-president. A report of the public policy committee was submitted by A. A. Dion, superintendent of the Ottawa Electric Company, and a full discussion took place.

The secretary read the report of the committee on line construction and grounding of secondaries which had been submitted by S. B. Hood, and following this Mr. Maclachlan, inspector of the Electrical Employers' Association, gave a very informing talk on the work being done in connection with the accident prevention committee of the National Electric Light Association and the United States Bureau of Standards. The report of the meter committee, which was sent in by P. T. Davies of the Montreal Light, Heat & Power Company, was placed before the meeting, but it was pointed out by Mr. Davies that he regarded his data as not quite complete, and it was voted to have the full report in three months' time.

The following officers and managing committee for the ensuing year were unanimously elected:

President, D. H. McDougall, Toronto Electric Light Company; first vice-president, H. G. Matthews, Quebec Railway, Light, Heat & Power Company; second vice-president, E. A. Dunlop, M. P. P., Pembroke Electric Light Company; third vice-president, A. Monro Grier, Canadian Niagara Power Company; honorary secretary, T. S. Young, 347 Adelaide Street, West Toronto; secretary-treasurer, Alan Sullivan, 910 Excelsior Life Building, Toronto; managing committee: W. G. Angus, Dominion Power & Transmission Company, Hamilton; P. T. Davies, Montreal Light, Heat & Power Company; M. C. Gilman, Toronto Electric Light Company; J. S. Gould, Citizens' Electric Company; H. M. Hopper, The St. John Railway Company; G. Ratcliffe Hulme, Canada Electric Company; George Kidd, British Columbia Electric Railway Company; E. L. Milliken, Cape Breton Electric Company; J. S. Norris, Montreal Light, Heat & Power Company; L. W. Pratt, Dominion Power & Transmission Company; the president National Electric Light Association; R. J. Smith, Canadian Electric & Water Power Company; James B. Woodyatt, Southern Canada Power Company.

Illuminating Niagara Falls

For years the cities of Niagara Falls, N. Y., and Niagara Falls, Ont., in conjunction with the commissioners of the State reservation at Niagara on the American side and of Queen Victoria Niagara Falls Park on the Canadian side, have been making efforts to effect the illumination of Niagara Falls so that visitors and observers might be able to view its beauties at night as well as in the daytime.

Demonstrations have been made from time to time with powerful lights, but the cost of installation and maintenance has been greater than the finances available for this work would permit, and although money had been appropriated by the city of Niagara Falls, N. Y., it was not sufficient to carry out any of the plans presented.

The Western Electric-Davis system of flood-lighting, presented by Will J. Davis, Jr., was recently demonstrated under the personal direction of Paul A. Schoellkopf, one of the New York State commissioners, in conjunction with the city authorities of Niagara Falls, N. Y., and a partial illuminating system is now in operation, incorporating the use of some twenty-five of these floodlights projecting upon the American Falls. The installation is being constantly increased, and it is probable that in the near future 100 of these lights will be thrown upon the American Falls and Rapids.

The Davis system incorporates the use of 1000-watt incandescent lamps, which give a mellow yellow color to the light, representing the effect of sunlight, and the result thus far has been very pleasing to the eye. It is anticipated that the larger plans being carried out will produce a spectacle during the night which will rival the grandeur of the falls during the daylight. In fact, in the estimation of many, the contrast of the sunlight effect and darkness makes the falls even more beautiful as illuminated than as seen in the daytime.

It is proposed to increase the lighting of the American Falls gradually, conforming to the approbation of observers for different locations and intensities of lights, and when this project is carried out to the satisfaction of all the lighting of the Horseshoe Falls will be begun, and it is planned and expected that within a few weeks the complete illumination will be nightly in evidence.

The cities at Niagara Falls and the officials charged with the care and preservation of this world wonder are endeavoring to make its beauties available for the pleasure of the whole country during the full twenty-four hours, and are giving thought and care to the end that these falls may be enhanced, preserved and protected for generations to come.

Bare Grounded Return Wiring Systems to Be Investigated

The committee on electric wiring systems of the electrical industry has appointed the following sub-committee to investigate bare grounded return wiring systems: Chairman, C. E. Corrigan, Associated Manufacturers of Electrical Supplies, Pittsburgh, Pa.; W. H. Flandreau, International Association of Municipal Electricians, Mount Vernon, N. Y.; J. C. Forsyth, American Institute of Electrical Engineers, New York, N. Y.; G. S. Lawler, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.; C. Renshaw, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; secretary, William S. Boyd, Western Association of Electrical Inspectors, 175 West Jackson Boulevard, Chicago, Ill.

Co-operation on the part of the entire electrical industry is desired by the committee in this work, and to that end it has requested that all information and data on wiring systems having a bare grounded conductor be sent to the secretary.

The following information in respect to such systems is being sought:

1. Safety, cost and reliability data based upon practical experience with concentric wiring, or any other type of wiring having one or more bare or partially covered conductors which are permanently connected to earth.

2. Theoretical or tested installation details or protective features which will safeguard concentric wiring

or other wiring systems having bare grounded conductors.

3. Reliable methods of preventing meter setters or linemen from reversing the polarities of a two-wire system.

4. A suitable definition of "ground" or "earth" as these words relate to electric wiring.

5. Practical experience with ground or earth connections: (*a*) whether they have been found reliable or unreliable; (*b*) the proportion found to be unreliable, if any.

6. Adequate methods of establishing and maintaining a reliable ground or earth connection for safety purposes.

7. A simple method of test which will insure the detection of unreliable ground or earth connections.

8. Economies which may be practiced with safety in connection with any of the existing wiring methods.

9. Estimates or actual figures as to the cost of any protective features reported upon in response to the foregoing requests.

10. Any data or experience calculated to assist the committee in reaching an accurate conclusion relative to the practicability of bare grounded return wiring systems.

Oregon Power Company Organization Changes

The general reorganization of the operating force of the Oregon Power Company has been announced by A. Norman, vice-president and general manager of that company. The Oregon Power Company is a member of the Byllesby group. Instead of having local managers in a number of towns, the company will be divided into divisions and districts. The operation of the Oregon Power Company will be under the direct supervision of Mr. Norman, and there will be two divisions, the Coos and Willamette. The Willamette division will be divided into the Eugene, Albany, Junction City, Corvallis and Dallas districts. The Coos division will be divided into the Marshfield and Coquille districts. J. L. White of Albany has been promoted to be superintendent of the Willamette division, A. L. Martin of Dallas will take charge of the Coos Bay division, and R. U. Steelquist of Corvallis will have charge of the Dallas district.

Public Service Commission News

Illinois Commission

The powers of the State Public Utilities Commission are defined somewhat in a recent decision of the Supreme Court in the case of the People ex rel the State Board of Administration versus Peoria & Pekin Union Railway and Scholl Brothers. "The Utilities Commission is not a court, but is an administrative commission charged with the performance of certain executive and administrative duties, and the law does not authorize it to ignore the decrees of courts where the courts have exercised jurisdiction," said the decision.

"A hearing before the Utilities Commission is not a judicial proceeding, although the statute provides for appeal to the Circuit Court of Sangamon County. Whether the determination of the Circuit Court of Peoria County was right or wrong, it must be accepted in the case as settling the rights of the parties."

Indiana Commission

For the first time in its history the Public Service Commission is asked to approve a profit-sharing plan to be established by a public utility corporation, in a petition filed recently by the Noblesville Light & Power Company. The company asks the commission to approve the organization of the Noblesville Electric Investment Fund, whereby the employees of the company may share in the dividends of the company.

The plan provides that all employees who have been with the company six months will obtain a percentage of their salaries and wages equivalent to one-fourth of the rate of dividend paid on the common stock of the company. Employees with the company one year will obtain a percentage of their wages equivalent to one-half the rate of dividend, those with the company two years will obtain a percentage equal to three-fourths the rate of dividend, and those with the company three or more years will receive a percentage of their salaries equivalent to the full rate of dividend.

The company asks the approval of the commission of the plan under the terms of Sec. 27 of the public utility act, which provides that "nothing in this act shall be taken to prohibit a public utility from entering into any reasonable arrangement with its customers or consumers or with its employees or with any municipality in which any of its property is located, for the division or distribution of its surplus profits or providing for a sliding scale of charges or other financial device that may be practicable and advantageous to the parties interested. No such arrangement or device shall be lawful until it shall be found by the commission, after investigation, to be reasonable and just and not inconsistent with the purpose of this act. Such arrangement shall be made under the supervision and regulation of the commission."

Wisconsin Commission

In fixing and determining the just compensation for severance to be paid the Falls Light & Power Company by the city of Sheboygan Falls for the property of the company actually used and useful for the convenience of the public, the Railroad Commission held that the fact that certain property used for joint purposes cannot be found to be used and useful under the terms of the public utilities act does not relieve the commission from the duty of considering the property jointly used and assessing such damages for severance, etc., as will do no injustice to the company whose property is being taken.

While early losses in the operation of a plant throw some light on the cost of development, these losses are not to be used where they are out of the ordinary. In using the comparative plant method of estimating the going value of an electric plant, costing about $19,000 to reproduce, excluding land, and materials and supplies, and located in a town of about 2000 inhabitants, a period of three years is a sufficiently long allowance for the development of the business to a paying basis, it being usually possible to put an electric plant on such a basis in a shorter time than is the case with some other public utilities.

The company in question is operated in connection with the tannery of its owners, C. S. Weisse & Company. The tannery company antedated the other business by eighteen years, and the formation of the company by twenty-eight years. The launching of the electric utility business was collateral and incidental to the other enterprise, though operated jointly with it. Due to such fact some of the units since installed are larger, or of a different character than would have been the case had either business operated entirely independently. The ascertainment of original cost is practically impossible in the case. In its report, expenditures of the utility are shown to be very heavy, due to failure to properly allocate the accounts between the utility and the tannery business.

Large Savings by New York Edison Employees.—In a report presented before the twenty-ninth annual convention of the New York State League of Savings and Loan Associations at Elmira, N. Y., it was shown that the employees of the New York Edison Company had in four years saved $350,000.

Doherty Engineers Meet at Joplin.—The annual meeting of the superintendents and engineers in the Southwestern properties, operated by Henry L. Doherty & Co., was held on June 21-24 in Joplin, Mo., at the Connor Hotel. Thirty-four delegates attended and talks were given by George E. Hayler, general manager of the Empire District Electric Company; W. G. Williams, construction engineer, New York, and N. F. Paige. During their visit the delegates inspected the different substations in the Empire District. Milan R. Bump, who returns to the Doherty organization as chief engineer, addressed the delegates.

U. S. Reclamation Service Electrical Statistics.—The electric output of the various power plants of the United States Reclamation Service operated in 1914 was over 66,000,000 kw.-hr. The total capacity of the twelve plants in operation was 27,134 kw., and the first cost of the plants $2,542,000. Of the total output, 39 per cent was sold to customers, 32 per cent was used for irrigation pumping, 17 per cent for construction purposes, 4 per cent for drainage, the remaining 8 per cent represented losses. It was estimated that the power remaining undeveloped on all the different projects amounted to a total of 489,000 hp. Of this 360,000 hp. consisted of the estimated capacity on the Flathead River in Montana, the remainder being distributed through twenty-one other power sites.

Washington Water Power Eliminates Maximum Demand Charge.—The Washington Water Power Company of Spokane recently announced a complete change in the present method of computing the electrical rates, to take effect within the next ninety days. The company will be the first in the Northwest to eliminate the maximum demand charge in the computation of electric rates, which will affect all energy secured after Aug. 31. H. L. Bleecker, vice-president of the company, in announcing the new business rate, quoted figures affecting practically every business account in the city. In many cases individual accounts will be cut almost in half. The new rates will affect approximately 50 per cent of the light and power business of the company, and applies to accunts that do not fall under the residential rate scale, which started on July 1 under an agreement with the city. Under the new schedule there will be a cut of from 25 to 50 per cent in the present commercial rates. The new rate is based on the kilowatt-hours consumed, with no "maximum demand or readiness to serve" charge. The minimum bill will remain at $1 per month, no matter how large the electrical load. A consumer with an installation of 50 kw., using 5000 kw.-hr. per month, would pay the company $115.50, a reduction of 41 per cent.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Substation Cut In in Minute and a Half.—The Boston Edison Company recently cut its new Stoughton distributing station into service, the time taken being a minute and a half. The incoming voltage is 13,000, which is stepped down to 2200 volts.

Chattanooga & Tennessee River Power Company Loses Mosquito Case.—The Circuit Court jury in the case of Thomas Lawson versus the Chattanooga & Tennessee River Power Company returned a verdict for $3,000 against the defendants. This was one of a series of suits brought by residents living along the Tennessee River, above Hale's bar lock and dam, to hold the power company, builders of the lock and dam, liable for the creation of pools and lagoons, breeding places for mosquitoes, thereby causing an epidemic of malarial fever. Motion for a new trial was entered.

Continued Demand for Quicksilver.—The domestic quicksilver industry has continued active during the first six months of 1916, and the average price for the period has been about double the exceptionally high average for the entire year 1915. Figures just compiled by the United States Geological Survey show that the total production of quicksilver in the United States in 1915 was 21,033 flasks of 75 lb. each, having a market value of $1,826,912, or an average of $86.86 per flask. Of this output 14,283 flasks, selling for $1,174,881, came from California, and the remainder almost entirely from Texas and Nevada. In 1914 the domestic output was 16,548 flasks, valued at $811,680, and therefore the production for 1915 showed an increase of more than 27 per cent in quantity and 125 per cent in value.

Copper Production Continues Heavy. Under the influence of large demands and resultant high prices the production of copper during the last six months has exceeded that of any equal period in the history of the industry. The United States Geological Survey states that there has been a steady rate of increase in the output of copper since early in 1915. The production during the last half of 1915 considerably exceeded that of the first half, according to the report by B. S. Butler of the Geological Survey, and during the year the refineries produced, from both domestic and foreign ores, a total of 1,634,000,000 lb. of blister copper, of which 1,388,009,527 lb. was produced from ores mined in the United States. The price for the period has averaged above the highest price received for copper at any time in recent years, the average for the first six months of 1916 being more than 26 cents a pound.

New Central Station Office at Huntington, Ind.—The Huntington Light & Fuel Company planned to open its new modern office building for the inspection of the public on July 3 and 4. Formal invitations to inspect the building have been tendered to the company's customers and its other friends.

Large Number of Employees Buy Stock.—Recently compiled reports show that 1327 or 23.76 per cent of the 5561 employees of the Commonwealth Power, Railway & Light Company, operating electric, gas and street railway properties in Michigan, Indiana, Illinois and Wisconsin, took advantage of the opportunity given them last January of purchasing stock in the company. These employees bought a total of 7166 shares with a par value of $716,000.

List of Charging Stations in New England and Middle Atlantic States.—The B. F. Goodrich Company has issued a new and revised list of all electric charging stations in New England, New York, New Jersey and Pennsylvania. This folder is distributed free of charge in connection with the Goodrich Touring Bureau for the benefit of the electric vehicle owner. This new list, besides giving the name and address of every electric charging station of good standing, classifies each one as to facilities. Boosts can now be figured out in advance and a tour planned weeks ahead.

Lead and Zinc Mines Promise Largest Output on Record.—Reports received by the United States Geological Survey show that the mine production of lead and zinc ores during the first six months of 1916 was much larger than that of any preceding six months. The lead and zinc mines have been able to produce all the ore needed to supply the increased capacity of the smelters. The ore and concentrates were sold at prices which yielded large profits, notwithstanding increased costs of production and the working of large quantities of low-grade ore which could not be mined at a profit under normal conditions. High-grade zinc concentrates free or nearly free from lead and iron, continued to be in demand, and the base price offered for such concentrates was generally much higher than that offered for low-grade concentrates.

Birmingham Cannot Collect License from Power Company.—The city of Birmingham, Ala., has no right to collect a license from the Alabama Power Company, according to City Attorney M. M. Ullman, who advised the city commission to the effect that in his opinion, "the board cannot legally collect from the Alabama Power Company any license whatsoever upon any business done in the city of Birmingham connected with the production, transportation and distribution of electric current arising from the development of hydroelectric power for the use of the public and originating in a plant, until ten years after the beginning of the construction of such plant." The city's attorney's opinion is based on Sec. 2069 of the act passed by the recent Legislature, which exempts certain public utility corporations from taxation for a period of ten years.

Kansas City Jovian League.—On July 31 the Jovian Electric Club of Kansas City will take a boat trip on the steamer Chester, on the Missouri River.

Electrical Supply Jobbers Association.—The next meeting of the Electrical Supply Jobbers Association will be held at Cleveland, Ohio, on Oct. 10, 11 and 12.

New England Section, N. E. L. A.—The New England section of the National Electric Light Association will hold its fall meeting at the Maplewood Hotel, Pittsfield, Mass., the week of Oct. 17.

Pacific Coast Jobbers.—A meeting of the Pacific Coast Electrical Supply Jobbers was held at Del Monte, Cal., on June 21, 22, 23 and 24. At the open session on Saturday afternoon, Russell Lowry, president of the First National Bank of Oakland, Cal., spoke on "Trade Acceptancy."

Los Angeles Jovian League.—W. W. Middlecoff, attorney at law, spoke before the June 21 meeting of the Los Angeles Jovian Electric League on the topic "Electrifying the Law." He was followed by Dr. Sam Atkinson, secretary of the Motion Picture Freedom League, who delivered a lecture on "The Hyphenated American." In closing he said that the man who will do more to prevent an enemy from entering our country to-day is not an army officer, a government official or a politician, but an inventor—Thomas A. Edison.

American Electrochemical Society.—The American Electrochemical Society will meet in New York on Sept. 28, 29 and 30, and the outline of the program has just been announced. It is as follows:

Wednesday, Sept. 27, evening: General reception with registration at the chemical expositon, Grand Central Palace. Thursday, forenoon: Reading and discussion of papers; general subject, "Made in America"; afternoon: visiting the exposition; evening: complimentary smoker; an invitation will be extended to the members of the American Chemical Society and other visiting chemists and engineers. Friday, forenoon: Reading and discussion of papers; afternoon: visiting the exposition; evening: subscription dinner-dance. Saturday, forenoon: Reading and discussion of papers; afternoon: visiting the exposition.

Rochester Jovian League.—Through the efforts of the publicity committee of the Rochester (N. Y.) branch of the Jovian Order, the electrical industries of the city have set aside Saturday, July 15, to be known as "Rochester Electrical Day." Every contractor, jobber and fixture dealer will, on that day, close his business to the public. It is also expected that the Rochester Railway & Light Company will close its offices on Friday night instead of Saturday noon as usual. The committee is also trying to bring about the co-operation of the several hundred mechanics employed by the different houses, and have suggested that the local unions observe this day by having the annual outing at that time. It is expected that the officers of the different local bodies will take favorable action at meetings held early this month. Many of the employers will take advantage of this holiday by joining the trip planned by the Jovian Order. As in the past the Ontario No. 1 will be chartered to Cobourg and return and the day be spent in a good time generally.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Oregon Electrical Contractors' Association.—The first quarterly convention of the Oregon Association of Electrical Contractors & Dealers was held at Portland on June 28. The program included open house for all members at the secretary's office during the morning, auto trip over the Columbia Highway during the afternoon, and a banquet at Crown Point Chalet in the evening. W. L. Goodwin of San Francisco, founder of the association, who was to have been the principal speaker of the evening, was unable to attend.

San Francisco Electrical Development and Jovian League.—Walter D'A. Ryan of the General Electric Company addressed the Electrical Development and Jovian League of San Francisco on June 28, reviewing the rapid growth of the science of illuminating engineering and more recently the art of illumination. He announced that plans are about to be adopted for illuminating the entire business district of San Francisco. The system to be used throughout the business district is a modification of the Market Street arrangement which, he said, will for the first time combine artistically arc and incandescent lamps mounted on the same standard.

Illuminating Engineering Society Convention.—The preliminary list of subjects and the lectures to be given at the University of Pennsylvania, Philadelphia, Pa., under the auspices of the society and the university, from Sept. 21 to 28 inclusive, immediately following the annual convention of the Illuminating Engineering Society, have been announced as follows:

(a) General — (1) "Illumination Units and Calculations," A. S. McAllister; (2) "Modern Photometry," Clayton H. Sharp; (3) "The Principles of Interior Illumination" (two lectures), committee, J. R. Cravath, chairman; (4) "The Principles of Exterior Illumination," Louis Bell; (5) "Color in Lighting," M. Luckiesh; (6) "Architectural and Decorative Aspects of Lighting," Guy Lowell; (7) "Recent Developments in Electric Lighting Appliances," G. H. Stickney; (8) "Recent Developments in Gas Lighting Appliances," R. ff. Pierce; (9) "Modern Lighting Accessories," W. F. Little. (b) Special Lectures on Interior Illumination — (10) "The Lighting of Factories, Mills and Workshops," C. E. Clewell; (11) "The Lighting of Offices, Stores and Shop Windows," Norman Macbeth; (12) "The Lighting of Schools, Auditoriums and Libraries," F. A. Vaughn; (13) "The Lighting of Churches," E. G. Perrot; (14) "The Lighting of the Home," W. H. Jordon; (15) "Railway Car Lighting," G. E. Hulse. (c) Special Lectures on Exterior Illumination — (16) "Street Lighting" (two lectures), (a) P. S. Millar, (b) C. F. Lacombe; (17) "The Lighting of Yards, Docks and Other Outside Works," J. L. Minick; (18) "Headlights, Searchlights and Projectors," E. J. Edwards; (19) "Sign Lighting," L. G. Shepard; (20) "Building Exterior, Exposition and Pageant Lighting," W. D'A. Ryan.

Empire State Gas & Electric Association.—The committee on electric production of the Empire State Gas & Electric Association will hold a meeting in the Odd Fellows' Temple, Watertown, N. Y., on July 14 and 15. This meeting is open to representatives of the electric production departments of the member companies. The committee has arranged for some discussion on each of the following topics: "Ways and Means of Improving Boiler-Room Economies," this being a continuation of a topic discussed at the last meeting covering "Boiler-Room Efficiency Apparatus," "Motor-Driven Versus Steam-Driven Auxiliaries," "Cost Data on Treatment of Feed Water and the Effect of Soda Ash on Boiler Operation or Upon Metal of Boilers," "Bonus System for Firemen and Average Wage of Firemen as Compared with Other Men in Stations," "Cleaning of Condensers," "Methods of Making Records of Daily Operating Results," "Methods of Insuring Uniform Standards of Coal Supply," "Steam-Heating Business—Methods of Dividing Operating Costs Between Steam Heat and Electric Business."

Illuminating Engineering Society.—The Wednesday afternoon session of the ninth congress of the American School Hygiene Association which took place in New York City from July 4 to 8 was held jointly with the Illuminating Engineering Society. The following program on vision, lighting and sanitation was carried out: "The Vision of the School Child," by Dr. F. Park Lewis, Buffalo, N. Y.; "Incipient Blindness Among School Children and Methods of Prevention," by Gordon L. Berry, acting secretary, national committee for the prevention of blindness; "The Relation of Illumination to Scholastic Visual Efficiency and Health," by Dr. George S. Crampton, Philadelphia, Pa.; "Artificial Lighting of the School Room," by A. L. Powell, Harrison, N. J.; "Difficult Problems in School House Sanitation and Efforts to Solve Them," by Frank H. Wood, Albany, N. Y.; "Practical Application of School Surveys," by William J. Bray, professor of chemistry and hygiene, State Normal School, Kirkville, Mo.; "Corrective Hygiene in School Work," by Dr. F. M. Walters, Warrensburg, Mo., professor of physiology and hygiene, State Normal School, Warrensburg, Mo.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

DISCOUNTS ON ELECTRIC RANGES

License Arrangements Under Marsh Patent Grant Largest Discounts to Jobbers

Within the past few months the central stations of the country and particularly those in the Far West have made what might be called a real start towards placing electric cooking on a plane with other methods. It is recognized within the industry that to the central station belongs the credit for having developed this business. There is, however, a feeling among the Western companies that the electric range manufacturers are not acting fairly towards the central station in the matter of discounts. As was pointed out in the ELECTRICAL WORLD of March 18, the central stations feel that they are the logical ones to sell ranges and since they have sold far more ranges than any other branch of the industry they feel that any concessions on the part of the manufacturer in regard to prices or discounts should go to them first.

There are no indications that the situation that then existed has changed. At that time the jobbers, through the revision of discounts, were able to buy electric ranges for a smaller net price than the central stations. It was thought at the time that the decision of several operating companies to defer the introduction of the electric range in their territory until the manufacturers had remedied the unsatisfactory conditions would alter matters to the point where the central stations would receive more favorable discounts.

Later developments, however, point out that this is not to be expected in the near future. Manufacturers of electric ranges employing nickel-chromium resistance, wire naturally come under the Marsh patent, now owned by the Hoskins Manufacturing Company and the General Electric Company.

As with the other heating devices, it is believed that licensed electric ranges will be sold at such list prices and discounts as will insure the same minimum net price. Nor is it likely that manufacturers will have an opportunity to defeat this by selling range attachments and betterments at prices below their value. Such additions, attachments, etc., will undoubtedly be catalogued in the license agreement and the minimum permitted price in each instance definitely set down. Were the owners of the patent to do otherwise unscrupulous manufacturers would find here a loophole to offer an additional discount.

Should there be a certain minimum list price and a certain maximum discount, as seems most likely at the present time, there is no evidence that the discounts will be the same for the different branches of the industry.

The basic discount is expected to be in the neighborhood of 25 per cent, which is 5 per cent less than for other heating devices. The customary 5 per cent for carload lot shipments and 5 per cent for cash within thirty days will probably continue to be given unless by so doing the resulting net price is below a certain value when the discount for cash will probably have to be modified.

Indications now are that jobbers will receive the greatest maximum discount which is not expected to exceed 45 per cent. Next, of course, come the central stations to which the maximum discount will probably never reach 40 per cent. To the remainder of the industry it is probably the maximum discount will be a per cent or two better than 30 per cent.

It is hardly possible that there will be any attempt made to prevent manufacturers paying freight on carload lot shipments to standard terminal points or otherwise to allow a small discount on carload lot shipments, f.o.b. factory should the buyer prefer.

ASBESTOS INDUSTRY SWAMPED

Factories Sold Out Completely for Next Two Months —No Deliveries Promised

So swamped is the asbestos industry with orders that it is impossible to obtain immediate or prompt deliveries of any large quantities of asbestos products. It is not believed that there is any shortage of raw material for apparently the factories have been able to obtain raw asbestos in sufficient quantities to keep up capacity production for some time. Shops are working night and day and practically every machine is busy. Even so production is not able to keep up with the demand, and it has been necessary to order new machinery to take care of this business.

An inquiry for asbestos products brought out the information that factories are sold out to the first of September and that the first of January, 1917, is the earliest that one can expect shipments, but no deliveries are promised.

In electrical and machinery supplies especially has the demand been heavy. There has been a large volume of business in both conduit and insulation.

In addition to the law of supply and demand, other important factors causing the price of asbestos to advance have been the increased costs of labor and mining facilities. Prices of asbestos products have advanced on an average of 25 per cent.

FOREIGN INQUIRIES FOR AMERICAN PRODUCTS

European War Has Shut Off Germany's Output of Electrical Materials—World Now Turns to the United States for Supplies

When the European war broke out Germany was supreme as an exporter of electrical goods. German electrical exports were equal to the combined exports of the United States and Great Britain, and German goods went to every corner of the globe.

Next to Germany came England as an exporter of electrical goods, and the United States was a poor third. Germany's electrical exports for the first six months of 1914 were greater by about $6,000,000 than America's record made in 1913, and greater by about $2,000,000 than the best estimate made for 1916, namely $32,500,000.

German electrical exports are now practically nil and have been so for almost two years. English electrical exports reached a maximum of around $37,000,000 in 1913, dropped to around $25,000,000 in 1914 and to around $22,000,000 in 1915.

Thus the export trade of the world in electrical goods which in 1913 was in the neighborhood of $125,000,000 in 1915 was less than $50,000,000. The war has, of course, curtailed purchasing power but it is hardly true that the amount of electrical goods exported during 1915 by the different nations was any index of the purchasing power in that year.

Ever since the war began there has been a demand by foreign markets for electrical goods to take the place of those formerly supplied by Germany. England was in no position to look for foreign trade, and even if the trade were offered to English manufacturers at higher prices it would have been refused. English manufacturers had their hands full supplying the needs of their old customers and are also supplying the government with munitions.

The natural place for these foreign orders to come was the United States—and they came. Inquiries almost without number were sent here. Natives of almost every im-

portant commercial center in the world wanted agencies to handle American electrical goods. These were men schooled in the art of selling electrical goods in their native lands.

There has come through the ELECTRICAL WORLD inquiry after inquiry for the names of manufacturers who could furnish electrical goods of almost every type and description in large quantities. Lamps were wanted by the millions. There were inquiries for sockets such as are made in Germany. A small plant in Uruguary wanted a few miles of wire, a couple of small generators and a thousand or so of meters. Germany would have had this order under normal conditions but since it was not possible to obtain German goods, a representative was sent all the way to the United States to place this order. This was done because the South America representatives of American houses had never given service.

After seeing a few of the inquiries that have come to this country and after seeing the monthly totals for electrical goods exported from this country the question naturally arises—"What has happened?" It is certain that American manufacturers have not taken advantage of the opportunity to supply the markets of the world with electrical goods.

An Indian correspondent of the London *Electrical Review* writes "American ceiling fans hold a good grip of the Indian market, but the deliveries this season are wofully late; it is somewhat astonishing that America has not pushed the electrical accessories business more strenuously in India. The big American companies have hitherto done well in a big machinery way; but they appear to have neglected the smaller lines—in which there is money to be made."

A prominent American export broker well established in the London trade brought orders to this country for a large quantity of wire and also of lamps. He could not place the order. Either the American manufacturer wanted a price that was prohibitive or he would promise no deliveries better than several months or both. There seemed to be a feeling throughout the American trade, this man thought, that there was enough business right here, so why bother with exports. Incidentally this order went to a Japanese manufacturer.

TRADE IN INSULATING PAINTS AND COMPOUNDS

Shortage of Dyes and Solvents and Other Increased Costs Lead to Advance in Prices Which Have Probably Tended to Curb Sales

Business in insulating paints and compounds has been good, bad and indifferent. By this is meant that some manufacturers have had a wonderfully fine demand for their product, some a poor demand, while others report a normal amount of sales. It is well known that there has been an abnormally large demand for electrical products requiring insulating paints and compounds. Especially has the manufacture of motors been enormous. Of course, there has not been the extension of systems or the sale of generators and cable that there would have been had the prices of these products been more nearly normal. On the other hand, it is probably true that for the very reason of the high prices of electrical products and the slowness of deliveries many motors, generators, cables, etc., that under ordinary circumstances would have been scrapped have instead been overhauled and repaired. Motors and generators have been rewound to save the expense of a new machine so as to have them working without waiting six or eight months, as would be necessary were a new machine ordered. Consequently there has been a wide market for insulating paints and compounds, especially varnish.

Business, it is stated, has been phenomenally good in the sale of spirit varnishes and, notwithstanding the above normal prices in force at the present time, the demand for this product exceeds any had in recent years. Factories making spirit varnishes, it is understood, have been working overtime since last fall. This business, of course, has been stimulated somewhat by the demand for quick-drying lacquers for coating shells, cartridges, etc., being made for European nations.

This market, it is thought, will be maintained and perhaps be bettered. It is expected that prices will come down, and dependent upon lower prices there will be a large amount of electrical construction work.

On account of higher wages, shipping rates, prices of oils, solvents and colors, prices have advanced proportionately over the prices of normal times.

The cause for the recent advance in the price of oils, of course, is scarcity of seed in the linseed field and the inability to secure bottoms for the transport of oil from China. This latter reason also applies to fossil and semi-fossil gums. The reason attributed by the petroleum oil concerns for the advance is the high price of crude oil.

The advance in price of aniline, as is well known, is due to the inability of Germany to land these colors in this country. The advance on this line of material has been tremendous. As an example, the normal price of nigrosine is about 30 cents per pound while the present price is $3.50 per pound and it can be obtained only in small quantities. The domestic manufacturers of nigrosine are endeavoring to make contracts dating from Jan. 1, 1917, at a price of $1.50 per pound with reductions from time to time covering a two-year period. Unfortunately these manufacturers, it is understood, are not prepared to make deliveries before January, 1917.

Deliveries, while longer than under ordinary conditions, are much better on the whole than they were a few months ago. Freight and factory congestion, and difficulty of getting deliveries of raw products, and then in any quantity have been responsible, it is said, for the longer deliveries of paints.

Some companies have been compelled to make inroads on their liquid capital to make necessary extensions because of increasing business, and there are indications that longer credits will be expected in those quarters for a time at least. On the whole, however, credits and collections are good.

DIPPED LAMPS BRING SATISFACTION IN CHICAGO

More than 300,000 in Use on Commonwealth Edison Lines, and Demand Has Greatly Increased in Past Few Months

To offset the extreme brightness of the larger sizes of tungsten filament lamps, the Commonwealth Edison Company of Chicago about six months ago began offering customers 60-watt opal dipped lamps in addition to the clear-bulb type. Since that time the 50-watt size in both the dipped and clear-glass types has been added to the free renewal list, and the company is endeavoring to persuade customers to use the opal lamp exclusively in the 50-watt size in spite of the fact that the cost to the company is thereby increased more than 1 cent per lamp.

Numerous tests were made on the dipped lamps before they were given out, and at first wide distribution of the new units was not strongly encouraged. With the increasing satisfaction which the dipped lamps have brought to customers, the demand for them has increased and the company has been thoroughly convinced of their practicability. The result has been that dipped lamps in the larger sizes are now being strongly advocated. More than 300,000 of these lamps are now in use on customer's premises.

The greatest difficulty the company encountered was in obtaining a satisfactory dip to insure reasonably long lamp life. After experimenting with eight dips, two were found which, on the ordinary 60-watt, type B tungsten lamp, give a lamp life in excess of 1200 hours. These dips are made by two Chicago concerns, namely, Heath & Milligan Manufacturing Company, and C. E. Franche & Company. The dip produced by these two concerns is now being used exclusively by the Commonwealth Edison Company.

Tests show that the dip absorbs approximately 10 per cent of the light generated, but the company believes that this small reduction in light is far more than offset by the improved quality, the eye protection, the softer shadows and the more pleasing lighting effect which result from the larger light-giving surface. The dipped lamps possess the added advantage of being more readily maintained, since they do not easily accumulate dirt and may be washed without injury to their coating.

Manufacturing and Industrial

The Standard Woven Fabric Company has recently moved its executive and sales offices from Framingham, Mass., to Walpole, Mass.

Federal Trade Commission Appropriation.—The House of Representatives has passed a bill granting appropriations of $446,000 for the Federal Trade Commission for the year which began the first of July. This is an increase of $91,000 over the past year, but almost $200,000 less than asked by the commission.

The Rice & Walden Electric Company, Hartford, Conn., has recently been formed and is the successor to Willard A. Rice, electrical contractor. The company will be engaged in electric construction and repair work. Willard A. Rice is president and treasurer of the company; Albert E. Walden, vice-president, and V. A. Sykes, secretary.

P. W. Sotham & Company, 40 Exchange Place, New York, engineers, have recently organized a company to carry on general electrical construction work, such as erecting transmission lines, installation of submarine cables, construction of underground distributing systems, power plants, lighting plants, electric railway systems, etc.

Protest on Transportation Rates Charged on Electric Lamps.—The Portland (Ore.) Traffic & Transportation Association has filed a protest with the Interstate Commerce Commisson against the rate charged on electric lamps from manufacturing points on the Atlantic Seaboard to Portland. This commodity, under the present rate, takes double the first-class rate of $7.40 per 100 lb. The commission will be asked to fix a lower rate.

H. Boker & Company, Inc., New York, have opened a new electrical department in which will be handled motors, dynamos, fan motors, pumps, etc. The company has secured the sole rights as agents in the United States for the celebrated Italian company, Ercole Marelli & Company. C. H. Champion, formerly vice-president and general manager of the Kandem Electric Company, New York, has been appointed manager of the new department, with J. A. Ryan as assistant manager.

The Calebaugh Self-Lubricating Carbon Company, 1503 Columbia Avenue, Philadelphia, Pa., announces that the "No-Spark" carbon brushes, which it has developed, wear smooth, take a high polish and produce a rich-chocolate color gloss on the surface of the commutator. They also make brush contacts frictionless, the maker further points out, and permit the machines to run noiselessly with a minimum amount of wear on the commutators. The brushes are moisture proof and will not chip, it is claimed, or split or break.

Central Telephone & Electric Company Purchased.—F. D. Phillips, who was formerly sales manager for the Wesco Supply Company, St. Louis, has purchased the interests which C. H. Wallis, vice-president, and Leo D. Brandewiede, treasurer, formerly held in the Central Telephone & Electric Company of St. Louis, Mo. Charles C. Brown, the company's former secretary, has also purchased a larger interest in the company, and he, with James S. Cumings, who will continue as president, will complete the active directorate.

Manufacturing Companies Consolidate.—The Steel Products Company and the Metals Welding Company of Cleveland and the Michigan Electric Welding Company of Detroit, all manufacturers of automobile and gas engine parts and accessories, have been consolidated under the name of the Steel Products Company. According to an official statement, the assets of the combined companies amount to $2,397,467 and the liabilities to $167,636. C. E. Thompson, who has been at the head of the three companies, is president of the consolidated company.

Present Trade Level to Continue.—F. M. Bernardin, president of the B-R Electric & Telephone Manufacturing Company, Kansas City, Mo., foresees a continuance of the present level of trade, without much diminution, if any—and without much increase—under the present costs of materials. He suggested that in the smaller towns there was disinclination to extend service lines while copper is high. Copper at 24 cents means a constantly increasing business, while 30 cents seems to be the line where many managers of plants hesitate. The larger central stations, however, are continuing their activities.

Specialty Firm Dissolves Because of Mexican Trouble.—Orr & Lockett, one of Chicago's pioneer business houses, which was established in 1872 and which has had a national business in hardware and electrical specialties, has gone into voluntary liquidation. This action was taken when it became necessary for Kenneth Lockett, vice-president, and Harold Lockett, general manager, either to refuse to take the federal oath with the Illinois National Guard, of which they are officers, or to quit business. The business has been turned over to the Chicago Association of Credit Men to liquidate. Liabilities amount to $231,000 with assets at $364,000, of which $250,000 is stock and $114,000 is accounts receivable.

Sulphuric Acid Production in 1915.—The production of sulphuric acid, expressed in terms of 50 deg. acid, in the United States in 1915 was 3,868,152 short tons, valued at $29,869,080, together with 189,795 short tons of oleum or fuming acid of different strengths, valued at $2,787,971, making a total of 4,057,947 short tons, valued at $32,657,051. These figures, just made public by the United States Geological Survey, include so-called by-product acid, or acid produced at copper and zinc smelters. The production of acid from this source in 1915 was 1,056,830 short tons, expressed in terms of 50 deg. acid, valued at $7,042,126, together with 59,189 short tons of oleum of different strengths, valued at $579,115.

The Esselstyn-Murphy Company.—H. H. Esselstyn, construction engineer of the Detroit Edison Company, and L. F. Murphy, formerly manager of the Walkerville (Ont.) Light & Power Company, have formed the Esselstyn-Murphy Company, which is to be engaged in engineering work and have offices at 1550 Penobscot Building, Detroit, Mich. Mr. Esselstyn retains his connection as construction engineer for the Detroit Edison Company in charge of design and construction of all power and heating plants and buildings. For fifteen years he was with Westinghouse, Church, Kerr & Company of New York. Mr. Murphy previously was connected with the J. G. White Company of New York, the Detroit Edison Company and the Walkerville Light & Power Company.

Ambler, Ott & Riter have recently been organized to engage in the consulting engineering field with offices in the Kearns Building, Salt Lake City, Utah. The members of the firm are J. B. Ambler, O. W. Ott and L. J. Ritter. It is the intention of this firm to furnish consulting engineering services on hydraulic, mechanical and electrical installations covering investigation, design, purchasing and installation. The firm will be equipped to furnish supervision on construction work, and will also engage in the operating management of electrical and mechanical plants for factories, mines, mills and allied industrial enterprises. A feature of its work will be to act as engineering representative of Eastern manufacturers, who desire to have supervised the installation and operation of special electrical and mechanical equipment sold throughout this territory.

NEW YORK METAL MARKET PRICES

	June 27 Selling Prices Bid	June 27 Selling Prices Asked	July 3 Selling Prices Bid	July 3 Selling Prices Asked
	£ s d	£ s d	£ s d	£ s d
London, standard spot	102 0 0		101 15 0	
Prime Lake	26.62½	to 26.87½†	26.25	to 26.75†
Electrolytic	26.62½	to 26.87½†	26.00	to 26.50†
Casting	24.00	to 24.25†	23.87½	to 24.12½†
Copper wire	29.00	to 31.00†	29.00	to 31.00†
Lead	7.00		7.00	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	19.00†		18.00†	
Spelter	11.67½	to 11.92½	10.67½	to 11.17½
Tin, straits	39.00		39.37½†	
Aluminum, 98 to 99 per cent	60.00	to 62.00†	58.00	to 60.00†

OLD METALS

Heavy copper and wire	17.00 to 18.00†	17.00 to 18.00†
Brass, heavy	11.00 to 11.25†	10.50 to 11.00†
Brass, light	9.00 to 9.50†	9.00 to 9.50†
Lead, heavy	5.25 to 5.50†	5.25 to 5.50†
Zinc, scrap	9.00 to 9.50†	9.00 to 9.50†

*COPPER EXPORTS

Total tons for June 35,753

†Nominal.

Corporate and Financial

Alabama Traction, Light & Power Company, Ltd., Birmingham, Ala.—In his annual report for the year ended Dec. 31, 1915, President James Mitchell says: "In the directors' report of the previous year it was intimated that the earnings of the company would experience a material increase during the year 1915, and a reference to the consolidated income and operating statement will show how well this expectation has been realized. An even better showing would have been made had it not been for the inability of several large customers to obtain the promised deliveries of their apparatus, ordered from the electrical manufacturers. While the district in which this company operates has not yet experienced any direct benefit from the large munition and supply business which has favored many sections of the country, there has nevertheless been a steady and sound improvement in fundamental conditions. The company has been fortunate in having been able to stimulate in several directions the industrial advancement of the community served by it, notably at Anniston, where an important steel and ordnance plant has been opened up, and in Clay County, where valuable graphite deposits are now being operated economically, due in no small measure to the adequate supply of cheap power." The consolidated income and operating account for the company and subsidiaries follows:

Operating revenue:		
Light and power department		$876,270
Railway department		86,349
Gas department		46,895
Water department		4,832
		$1,014,346
Deduct:		
Rebates and discounts	$35,164	
Reserve for bad debts	6,668	
		41,832
Net operating revenue		$972,514
Deduct operating expenses:		
Light and power department	$285,760	
Railway department	71,676	
Gas department	34,954	
Water department	3,848	
General expenses	6,671	
		402,909
Net operating income		$569,605
Add:		
Interest on bonds owned	$408	
Interest on open accounts of subsidiaries	52,815	
Interest on notes, deposits, etc	20,979	
Profit on foreign exchange	2,440	
Interest on loans	4,503	
		81,145
Gross income		$650,750
Deduct:		
Interest on open accounts	389	
Gross income before deducting bond interest and depreciation		$650,361

Duquesne Light Company, Pittsburgh, Pa.—The annual report for the year ended March 31 states that owing to the depression in general business conditions which had existed in the Pittsburgh district since the inception of the war in Europe, no material increase in the company's business was shown until early in July. From that time until the end of the year the demand for electric energy for light, and especially for power, increased rapidly. This is shown by the increase of 6147 contracts during the year, representing a lighting load of 7566 kw. and a power load of 33,200 hp. Municipal lighting shows an increase of 601 tungsten and 254 arc lamps. The installation of the four 18,000 kva. turbo-generators at Brunot Island, and the extensions to the cable transmission system (made during the previous year), provided additional capacity to take care of the increased load due to the above-mentioned improvement in business, although the entire system was taxed to its limit to do so. On account of these conditions it was impossible to close down any of the smaller power stations, as the capacity of these plants was required to assist in carrying the load. In order to meet the rapidly-growing demand for energy, the company has found it necessary to increase the capacity of the Brunot Island Power Station by the installation of a 40,000-kw., cross-compound turbine unit and an additional 18,000-kva. turbine unit. These turbines and the necessary auxiliary equipment are now under order, with delivery promised for September of this year. It is fully expected to have this installation in operation in December, 1916. There is also under contract a submerged storage pit, the use of which will more safely provide for the storage of coal, large quantities of which are purchased during the summer, at which time it can be most advantageously obtained. During the year construction of the high-voltage steel tower line to the Beaver Valley was started. It is expected that this line will be in service within the next year and that power will be supplied from Brunot Island over it to the Beaver County Light Company, The Beaver Valley Traction Company and the entire Beaver Valley. This district is developing very rapidly and it is expected that a very large power load will be secured.

A summary of income and profit and loss for the year ended March 31, 1916, follows:

Gross earnings		$5,368,025
Operating expenses:		
Production	$1,300,424	
Transmission and distribution	456,712	
Customers'	67,413	
Municipal street lighting	84,887	
Laboratory	21,803	
Commercial	187,322	
General and miscellaneous	389,482	
Steam heading	4,820	
Total operating expenses	$2,512,863	
Taxes	160,011	
Total operating expenses and taxes		2,672,874
Net earnings		$2,695,151
Other income:		
Dividends and interest on stocks and bonds owned	$54,215	
Interest and discount	170,171	
Total other income		224,386
Total income		$2,919,537
Deductions from income:		
Rent of leased properties	$173,036	
Rent of power stations	291,237	
Interest and discount	163,314	
Miscellaneous	23,535	
Total deductions from income		651,122
Net income before deducting fixed charge		$2,268,415
Fixed charge—interest and funded debt		76,681
Net income after deducting fixed charge		$2,191,734
Other deductions:		
Discount, taxes and expenses in connection with the sale of securities	$306,242	
Improvements and betterments written off	24,437	
Provision for depreciation	246,568	
Total other deductions		577,247
Net income for the year		$1,614,487
Surplus April 1, 1915		571,116
Gross surplus		$2,185,603
Deductions from surplus:		
Dividends on preferred stock	$205,702	
Dividends on common stock	1,264,706	
Deferred account, improvements and betterments, written off	95,774	
Total deduction from surplus		1,566,182
Surplus March 31, 1916, per balance sheet		$619,421

Interstate Electric Corporation, New York, N. Y.—An initial dividend of 1 per cent on the $1,000,000 of common stock has been announced, payable on July 1.

Nevada-California Electric Corporation, Denver, Col.—The directors have declared a semi-annual dividend of 2.5 per cent on the outstanding preferred stock, payable on July 25 to stockholders of record on July 15. The dividend is the first one paid by the new corporation formed last year to take over the Navada-California Power Company, the Southern Sierras and associated companies. The dividend is to be paid out of earnings during the first six months of the present year.

Public Service Corporation of New Jersey, Newark, N. J.—The quarterly dividend for June of 2 per cent, which is another increase, has been announced. The March dividend was 1.75 per cent. Each year since 1907, when the dividend was 3 per cent, the company has made some increase in the dividend. In 1915 the dividend was 6.25 per cent.

Union Gas & Electric Company, Cincinnati, Ohio.—On June 28 it was announced that the company had sold 11,900 shares of the Cincinnati Gas & Electric Company's stock to strong interests and that it will likely not find its way back to the market. This stock was received from time to time for improvements and extensions made on the Cincinnati Gas & Electric Company's property. The price is said to have been around the present market figure.

New Utility and Industrial Companies

The Kale & Bryan Company has been incorporated with a capital stock of $10,000 by W. E. Bryan, Fred Kale and J. F. Devine, to manufacture electric signs.

The Newton (Tenn.) Light & Power Company has been incorporated with a capital stock of $2,000 by R. W. Clemmer, W. A. Prince, J. E. Cook, and others.

The Comment Light Company of Beaver Falls, Pa., has been chartered with a capital stock of $5,000. C. J. Brown of Pittsburgh, Pa., is one of the incorporators.

The Amber Electric Construction Company of Chicago, Ill., has been incorporated with a capital stock of $20,000 by Robert L. Lehr, L. Cleary and John V. Cleary.

The National Power Company of Richmond, Va., has been incorporated with a capital stock of $25,000. The officers are: S. R. Nichols, president, and S. Potter, secretary and treasurer.

The Albany Lighting Company of Clinton, Iowa, has been incorporated with a capital stock of $10,000 by C. E. Peck, C. A. Olds, H. R. Senior, K. D. Slocum and James Beach.

The Gurdon (Ark.) Electric Company has been incorporated by F. L. Stut, R. Swartz and G. P. Whittington. The company proposes to construct and operate an electric-light plant and ice factory.

The Hookstown (Pa.) Light Company has been incorporated with a capital stock of $5,000 by J. R. McNary, G. H. Pifer of Pittsburgh, Pa.; H. H. Montgomery of Whitaker, Pa., and E. W. Washabaugh of Dormont, Pa.

The Peerless Iowa Electric Sign Company of Sioux City, Iowa, has been incorporated with a capital stock of $120 000 to manufacture and operate talking electric signs. The incorporators are: R. L. Turner, F. W. Webb and S. W. DeWolf.

The Thomas H. Keffel Manufacturing Company of St. Louis, Mo., has been incorporated by Thomas H. Keffel, C. D. Halley, J. M. Smith and others. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical machines and appliances.

The Sandusky Creek Township Power Company of Franklin, Pa., has been incorporated with a capital stock of $5,000 to operate an electric light plant in Sandusky Creek Township. The incorporators are: J. B. Brooks, M. C. Cornell and Joseph McCormick of Erie.

The Westfield (Me.) Electric Company has been incorporated by R. J. Colbath, H. A. Anderson of Mars Hill, Me., and A. C. Frost of Limestone, Me. The company is capitalized at $10,000 and proposes to construct and operate an electric light and powerplant.

The United States Steel Electric Company of Connellsville, Pa., has been incorporated with a capital stock of $125,000 by Robert Lock of Apollo, Pa.; Worth Kilpatrick, Frank E. Markell, Robert Norris and F. T. Evans of Connellsville. Robert Lock is president.

The Scott Elevator Company of Yonkers, N. Y., has been incorporated with a capital stock of $1,000 for the purpose of manufacturing elevators, hoisting machinery, engines, dynamos, etc. The incorporators are: E. E. Gorton and Spreckels C. Scott, 34 Montgomery Place, Yonkers, N. Y.

The Willis Construction Company of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of doing a general contracting, electrical contracting business, etc. The incorporators are: E. Ellis, C. Combes and E. W. Stitt, Jr., New York, N. Y.

The Port-O-Phone Corporation of Esopus, N. Y., has been chartered with a capital stock of $100,000 for the purpose of manufacturing apparatus and devices for intensifying sound and for transmission of sound. The incorporators are: J. J. Baker, H. Leyser and S. C. Porter, 1919 Broadway, New York, N. Y.

The Albia Light & Railway Company has filed articles of incorporation under the laws of the State of Delaware. The company has a capital stock of $500,000 and proposes to own and operate railways outside of the State of Delaware. The incorporators are: Merle R. Walker, A. L. Fowle and A. S. Leland of New York, N. Y.

Trade Publications

Traffic Posts.—The George Cutter Company, South Bend, Ind., has prepared a folder which describes and illustrates its "Safety First" traffic posts.

Nippers and Pliers.—The Utica (N. Y.) Drop Forge & Tool Company has prepared an illustrated bulletin which describes various types of nippers and pliers.

Turbine Exciter Sets.—The Terry Steam Turbine Company, Hartford, Conn., has issued a catalog which contains information on its Duplex turbine exciter sets.

Motor-Generator Sets.—The Electric Specialty Company, Stamford, Conn., has published Bulletin No. 207 on its motor-generator sets for battery-charging and signal work.

Electric Clocks.—The Warren Clock Company, Ashland, Mass., has issued an illustrated folder which contains information on its electric clock which was recently described in these columns.

Direct-Current Motors.—The C & C Electric & Manufacturing Company, Garwood, N. J., has issued Bulletin No. 102-X on its Type IB motors with commutating poles and with ratings up to 10 hp.

Turbine Water Wheels.—James Leffel & Co., Springfield, Ohio, have issued Bulletin No. 54, which is attractively illustrated in colors and which contains information on several types of turbine water wheels.

Low-Voltage Transformers.—Bertrand F. Miller, Trenton, N. J., has prepared an illustrated booklet which contains information on Ajax "low-lite" transformers, bell transformers and sign transformers.

Motor-Generator Charging Outfit.—The Kewanee (Ill.) Private Utilities Company has prepared an illustrated folder descriptive of its motor-generator sets for charging, starting and lighting batteries.

Electric Tractors.—The Galion (Ohio) Dynamic Motor Truck Company has prepared an illustrated folder which contains information on a special type of electric tractor adapted for use in lumber yards.

Attachments for Pull Sockets.—Bulletin No. 15-20, issued by Harvey Hubbell, Inc., Bridgeport, Conn., contains information on and illustrations of attachments for pull sockets and also information on "Knostrain" bushings.

Portable Motion-Picture Lighting Unit.—The Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, is sending out an illustrated bulletin descriptive of its new portable lighting unit for motion-picture work.

Conduit Wrench.—The Mechanical Specialties Company, Peoples Gas Building, Chicago, Ill., is sending out several illustrated bulletins which contain information on a conduit wrench which was recently described in these columns.

Induction-Type Heaters.—The Coin Machine Manufacturing Company, Portland, Ore., has prepared several bulletins which describe and illustrate its induction-type electric water heater and electric melting pot for type-casting machines.

Small Generating Plants.—The Warner Lamp Company, Davenport, Iowa, has prepared a large-sized catalog and several illustrated bulletins which contain much information on various types of gasoline-engine-driven lighting plants and the uses to which the plants can be put.

Ball Bearings.—Catalog No. B-3, which has been prepared by the Gurney Ball Bearing Company, Jamestown, N. Y., is attractively illustrated and contains a large amount of information on various types of ball bearings and the uses to which they are put. The company has also prepared Bulletin No. G-1, descriptive of applications of radio-thrust bearings.

Lighting Fixtures.—The Frank Adam Electric Company, St. Louis, Mo., has prepared several attractively illustrated catalogs which contain information on its lighting fixtures. Catalog No. 2 lists various types of "Reflectolytes," while Catalog No. 28 contains information on various types of ornamental semi-indirect lighting and direct-lighting fixtures. The company has also prepared Catalog No. 22 on knife switches, panelboards, steel cabinets, switchboard material, etc.

New England

OAKFIELD, ME.—The Oakfield Light & Power Company, recently organized with a capital stock of $10,000, proposes to operate an electric-light and power plant in Oakfield. Nelson C. Martin, Walter E. Matthews of Oakfield, and William H. Kelley of Bangor are among the incorporators.

MILTON, N. H.—Plans are being prepared, it is reported, by I. W. Jones, engineer, for construction of a power house to cost about $100,000.

ST. ALBANS, VT.—The Public Service Commission has granted the Public Electric Light Company of St. Albans permission to erect a high-tension transmission line from its power plant at Fairfax to the substation on the outskirts of the village of Milton, a distance of about 7 miles, upon a private right-of-way; also to install an electric distributing system in the town and village of Milton. The company has also been authorized by the commission to issue $20,000 in capital stock to cover the cost of the above work.

BOSTON, MASS.—Bids will be received at the office of John Grady, fire commissioner, Fire Department of the city of Boston, Bristol Street, Boston, until July 10 for work in connection with underground fire alarm service, consisting of laying 2965 ft. of single duct, 473 ft. of two ducts, 26 ft. of four ducts, setting about 22 lamp-posts and one test post. Specifications may be obtained at the office of superintendent of fire alarms, Fire Department, Bristol Street.

BOSTON, MASS.—Bids will be received at the office of John Grady, fire commissioner, Fire Department, Bristol Street, Boston, until July 14 for furnishing rubber-insulated covered cable, consisting of 1000 ft. of 61-conductor, 3761 ft. of 20-conductor, 4543 ft. of 15-conductor, 12,482 ft. 10-conductor, 10,162 ft. of 6-conductor and 4928 ft. of 4-conductor cable. Specifications may be obtained at the office of the superintendent of fire alarms, Fire Department, Bristol Street.

MILFORD, MASS.—The Milford Electric Light & Power Company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $62,500 in capital stock, the proceeds to be used to take up floating indebtedness and for further additions to its plant.

PROVIDENCE, R. I.—The City Council has appropriated $55,000 for new fire-alarm equipment for the Fire Department.

TORRINGTON, CONN.—Plans have been prepared by Wilburn Workman, architect, for construction of a reinforced concrete boiler house at 422 Main Street for Henry Riler. The heating plant will also be enlarged.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school building, Board of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 17 for additions, alterations and repairs to the electric equipment in Public Schools 26, 45, 84, 136 and Manual Training High School, borough of Brooklyn. Blank forms, plans, etc., may be obtained at the above office and at branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The contract for illuminating the streets of Buffalo during the Shriners' convention in July has been awarded to Frederick Truscott & Son Company. About 20 miles of copper wire and more than 17,000 colored bulbs will be used to carry out the scheme.

LONG ISLAND CITY, N. Y.—Plans and estimates are being prepared by the engineers of the Long Island Railroad Company for extension of the electric zone of the company from Lynbrook to Babylon, a distance of about 19 miles.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until July 12 for alterations in Public Schools 40, 42, 43 and Morris High School, Borough of the Bronx. Blank forms, specifications, etc., may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the Public Service Commission, 120 Broadway, New York, until July 17 for construction of a railroad duct for the Lexington Avenue subway. The duct line to consist of a line of 30 ducts extending through Walton Avenue and East 157th Street from a point near 153d Street to River Avenue in the borough of the Bronx.

ROCHESTER, N. Y.—The City Council has adopted an ordinance requesting the Rochester Railway & Light Company to install conduits in Clarissa and Lowell Streets and in Clinton Avenue.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

WAVERLY, N. Y.—Plans are being considered by the Sayre Electric Company and the Board of Trustees for extensions to the local electric-lighting system.

BLOOMSBURG, PA.—The Columbia & Montour Electric Company of Bloomsburg has entered into a contract with the Philadelphia & Reading Railroad Company to furnish electricity to operate the signals and light the stations from Lewisburg to Newberry, making delivery of current at West Milton. Electricity will be distributed over the company's private lines.

CHESTER, PA.—The Beacon Light Company of Chester has engaged John T. Windrim, Commonwealth Building, Philadelphia, to prepare plans for proposed new power house, to cost $1,000,000.

ERIE, PA.—Bids will be received by the Commissioners of Water-Works, City Hall, Erie, until July 14 for furnishing and erecting a 20,000,000-gal. turbine-driven centrifugal condensing pumping engine. Plans and specifications, etc., may be obtained at the office of the commissioners, Erie, and at the office of Chester & Fleming, engineers, Union Bank Building, Pittsburgh, Pa. George C. Gensheimer is secretary of commissioners.

HARRISBURG, PA.—Governor Brumbaugh has approved the merger of the Bucks County and the Doylestown Electric Companies into the Pennsylvania-New Jersey Power & Light Company, with a capital stock of $100,000. Snyder L. Wright, of Philadelphia, Pa., is president and Gaylor Thompson of Trenton, N. J., is vice-president of the consolidated company.

HERSHEY, PA.—Preliminary surveys are being made by the Hershey Traction Company for a 16-mile extension in Lebanon and Lancaster counties.

LANSFORD, PA.—The Council has passed an ordinance granting the Panther Valley Electric Company permission to erect high-tension transmission lines through the town to the new substation of the company over the veto of the Chief Burgess Gallagher. An injunction will be served on the company by the Burgess.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford Arsenal, Philadelphia, Pa., until July 15 for furnishing master clock, relay panel, chronographs, etc.

POTTSVILLE, PA.—Steps will soon be taken to merge the Tremont & Pine Grove Electric Light, Heat & Power Company of Tremont, and the Auburn (Pa.) Electric Light Company with the Eastern Pennsylvania Light, Heat & Power Company of Pottsville.

ZELIENOPLE, PA.—Bonds to the amount of $12,000 have been voted for improvements to the water-works system and to acquire an electric-lighting plant.

FREEHOLD, N. J.—The Monmouth County Electric Company of Freehold has applied to the Board of Public Utility Commissioners for permission to issue $325,000 in capital stock for improvements to its system. The company has recently changed hands, Charles A. Porter, Jr., of Philadelphia, Pa., is interested in the company.

NEWARK, N. J.—The Public Service Corporation has voted to increase its capital stock from $25,000,000 to $50,000,000. The new stock will be issued from time to time for extensions and betterments to its plants and systems.

NEWARK, N. J.—A power house, to cost about $9,000, will be erected in connection with the new manufacturing plant for the Splitdorf Electrical Company at 340 High Street. Menk & Johnson are engineers in charge of the work.

BALTIMORE, MD.—Plans have been prepared by the United Railways & Electric Company, Continental Building, for the construction of a transformer station to be erected near Electric Park.

WARWOOD, W. VA.—The Wheeling (W. Va.) Electric Company, it is reported, has been awarded a contract to install 100 street lamps in Warwood.

NARROWS, VA.—The Narrows Light & Power Company has petitioned Congress for permission to construct a dam at Narrow Falls of New River. The company proposes to construct a hydroelectric plant at the falls.

WASHINGTON, D. C.—Steps have been taken by the Fourteenth Street Business Men's Association to secure a better lighting system on that thoroughfare.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 24 for ventilating apparatus in room No. 410, supervising architect's office. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Brooklyn, N. Y., Schedule 9833—10 electrically-operated ice cream freezers; Schedule 9862—furnishing and installing one oil-burning forge furnace; 9856—400 chemical thermometers, 150 thermometers for storage batteries, miscellaneous mechanical thermometers, 1100 mercurial thermometers, 650 mercury thermometers, 200 water thermometers; Schedule 9835—150 coaling trucks; Schedule 9850—one 1-hp. electrically driven blower, one 6-hp., 22-volt motor; Schedule 9839—11,700 ft. interior communication cable, miscellaneous material for switchboard panels, 1500 rolls of tape for electrical purposes, miscellaneous single-conductor wire; Schedule 9829—one 5-kw. radio transmitting set; Schedule 9832—12,000 ft. lighting and power wire, 30,000 ft. telephone wire, 3200 lb. weatherproof wire; Schedule 9840—miscellaneous hot and cold rolled sheet copper; Schedule 9861—hydraulic accumulator complete; Schedule 9859—one fire pump. Mare Island, Cal., Schedule 9846—7000 ft. flexible plow steel wire rope, 750 lb. copper wire. Boston, Mass., Schedule 9836—miscellaneous bronze wire; Schedule 9863—one temperature indicating system; Schedule 9839—2000 transmitting (jars) condensers; Schedule 9822—two air compressors; Schedule 9820—four electric deck winches. Philadelphia, Pa., Schedule 9839—seven W. T. annunciators, miscellaneous fiber rod; Schedule 9860—one centrifugal pump. Various navy yards, Schedule 9858—27,800 7 by 1¼-in. flashlight batteries, 8000 flashlights without batteries. Norfolk, Va., Schedule 9815—one exhaust fan complete. Key West, Fla., Schedule 9817—nine watt-hr. meters. Portsmouth, Brooklyn, Puget Sound, Schedule 9851—three 110-volt electric ranges. Puget Sound, Brooklyn, Schedules 9840 and 9847—miscellaneous hard drawn bar copper. Portsmouth, N. H., Schedule 9836—miscellaneous soft sheet sheathing copper. Norfolk, Mare Island, Schedule 9824—four main circulating pumps. Application for proposals should designate the schedule desired by number.

North Central

COLDWATER, MICH.—The city of Coldwater, it is reported, is contemplating improvements to the municipal electric-light plant and waterworks system, to cost about $25,000, for which bids are now being received. H. R. Fothergall, Thirty-second and Smallman Streets, Pittsburgh, Pa., is engineer.

HESPERIA, MICH.—At a special election held recently the proposal to grant John A. Reed and Frank H. Speese of Whitehall an electric-lighting franchise for a period of 30 years and a 30-year lease of the dam and water right on White River, owned by the village of Hesperia, was carried. Messrs. Reed and Speese also have an option on the water right at Ferry on the North Branch River and they propose to develop sufficient power to supply electrical service to small towns of southern Oceana and northern Muskegon counties.

LANSING, MICH.—Plans are being prepared by B. E. Parks & Sons of Grand Rapids for a 1500-hp. power plant for the W. K. Prudden Company, manufacturers of auto wheels.

PLYMOUTH, MICH.—At an election held June 19 the proposal to sell the municipal electric-light plant to the Detroit (Mich.) Edison Company was carried. The Edison Company will hereafter supply electrical service here.

PONTIAC, MICH.—The Detroit (Mich.) Construction Company has been engaged to prepare plans and construct an electric railway in Pontiac, to be built under a franchise granted to William H. Osmun. P. M. Lau is engineer for the construction company.

VANDERBILT, MICH.—The Vanderbilt Electric Light & Power Company will discard its steam plant about Aug. 1, when the oil engine plant will handle the entire load. F. King is owner and manager.

BOWERSVILLE, OHIO—Bids will be received by the village of Bowersville until July 24 for furnishing electricity for lighting the streets of the village for a period of ten years in accordance with plans and specifications on file with the Council of the village. Wilber Ross is village clerk.

CLEVELAND, OHIO—Bids will be received by Frank G. Hogan, director of schools, until July 17 for electric wiring in the Sowinski School, Cleveland.

COLUMBUS, OHIO.—A new ordinance will be presented to the City Council giving the Columbus Railway, Power & Light Company authority to build a power station, to cost about $300,000, on its site on the Scioto River, just north of Broad Street. The company will build a new retaining wall along the entire length of its property and the building will stand 50 ft. from the river bank, thus providing for flood prevention work on which the city is now working. Arrangements are being made by the company for the erection of a transmission line, 6½ miles long, to supply electricity in the southern section of the city. About 2½ miles of this will be placed underground.

KINGSCREEK, OHIO—Bids will be received by Robert G. Duncan, clerk of Board of Education of the Salem Rural School District, post office address R. F. D. No. 3, Urbana, Ohio, until July 24 for furnishing electricity for lamps and motors for the Salem High School at Kingscreek. Bids will be received for furnishing electricity from privately owned plants; also for furnishing and installing a complete electric plant, consisting of engine, dynamo, switchboard and set of storage batteries. Plans and specifications are on file in the above office. Bids will also be received for furnishing and installing the necessary fixtures, chandeliers, lamps, etc., to complete wiring system, which at present is complete from the center of distribution to the various outlets, ready for connection of fixtures.

MASSILLON, OHIO.—Plans prepared by H. O. Swoboda, of Pittsburgh, Pa., engineer, for new street-lighting system in Massillon have been approved by the City Council.

STEUBENVILLE, OHIO.—The Steubenville & East Liverpool Railway & Light Company will abandon its generating equipment as soon as the new plant of the American Gas & Electric Company at Beech Bottom (Wheeling, W. Va.) is completed.

NEWPORT, KY.—The City Council is considering a rearrangement of the street-lighting system, including the installation of a number of new lamps.

PERRYVILLE, KY.—The local electric-light plant, owned by Russell Brothers, was recently destroyed by fire, causing a loss of about $25,000.

ALVIN, ILL.—The Alvin Grain & Electric Company, recently incorporated with a capital stock of $10,000, is planning to construct and operate an electric-light plant in Alvin. F. M. Yeazel, and others, are interested in the project.

BERWYN, ILL.—Bids will be received by the City Council of Berwyn, Ill., until July 18 for the installation of a street-lighting system, to cost about $18,000. For details see proposal columns.

BONE GAP, ILL.—Work has begun on the construction of an electric lighting system in Bone Gap.

DECATUR, ILL.—Bids will be received by the city of Decatur, Ill., until July 13 for furnishing and installing one cross-compound, condensing, crank and flywheel Corliss pumping engine, opposed type. For details see proposal columns.

DE KALB, ILL.—The City Council has adopted a resolution that a committee be appointed to make investigations as to the cost and maintenance of a municipal electric-lighting and pumping plant. The contract with the De Kalb-Sycamore Electric Company has five or six more years to run.

OTTAWA, ILL.—An ordinance requiring all electric wires in the business district placed underground is under consideration.

PEORIA, ILL.—Plans are being considered by the Association of Commerce for improvements to the street-lighting system.

ALTOONA, WIS.—The installation of a municipal electric-light plant in Altoona is under consideration.

ODANAH, WIS.—The franchises issued to D. U. Parkinson for installation of electric-lighting and telephone systems in Odanah have been purchased by A. E. Appleyard of Ashland.

OREGON, WIS.—The Village Board has accepted the proposal of the Oregon Electric Company to construct and operate an electric-light plant in Oregon for a period of ten years.

FOSSTON, MINN.—The village of Fosston is contemplating the installation of an ornamental lighting system this summer. The plans provide for 42 standards. H. Halverson is superintendent.

WABASHA, MINN.—Bids will be received by John W. Murdock, clerk of board of education, Wabasha, until July 14 for construction of school building, separate bids to be submitted for electric wiring, plumbing, heating, program clocks and telephone system. Chandler & Park of Racine, Wis., are architects.

ALLERTON, IOWA.—The Centerville (Iowa) Light & Traction Company has purchased the municipal electric-light plant in Allerton, subject to the approval of the voters. Energy to operate the local system will be supplied from a transmission line which will run near Numa, Seymour and Corydon.

CEDAR HEIGHTS, IOWA.—Arrangements have been made whereby both the municipal and electric-lighting and water service will be extended to Cedar Heights, a suburb of the city.

CLINTON, IOWA.—The installation of an ornamental lighting system on Fifth Avenue during the summer is under consideration.

DAYTON, IOWA.—Bonds to the amount of $15,000 have been voted for the installation of a distribution system in Dayton and the erection of a transmission line to Harcourt. Electricity to maintain the system will be obtained from transmission system of the Fort Dodge, Des Moines & Southern Railway Company.

DES MOINES, IOWA.—Work will soon begin on improvements to power plant of the Des Moines Electric Company, including an addition to power house and installation of new boilers, to cost about $50,000.

LETTS, IOWA—Improvements are contemplated to the local electric-lighting system. It is proposed to erect a transmission line connecting Letts with a nearby town and transmit sufficient energy to supply electrical service in Letts and neighboring rural districts.

OSKALOOSA, IOWA.—The installation of a new street-lighting system is under consideration.

SIOUX CITY, IOWA.—Bids will be received by the Commissioners of Woodbury County, Sioux City, Iowa, until July 24 for mechanical equipment for county court house, separate bids to be submitted as follows: for heating and ventilating equipment; plumbing and gas piping; electric apparatus and electric wiring; power system. William Steele, United Bank Building, Sioux City, Iowa, is architect. E. E. Hosmer is county auditor.

WORTHINGTON, IOWA—The Iowa Railway & Light Company of Cedar Rapids has submitted a proposal to the Council offering to extend its electrical service to Worthington.

CLEARMONT, MO.—The Maryville Electric Light Company is erecting a transmission line from Clearmont to Burlington Junction; also one from the latter place to Maryville. The City Council has voted to install a street-lighting system in Clearmont.

KANSAS CITY, MO.—The Mayor has approved the recommendation of S. F. Scott, supervisor of lights, that arc lamps now in use throughout the city be replaced with tungsten lamps. It is estimated that $15,000 can be saved by the change. The Kansas City Electric Light Company furnishing the street-lighting service.

MARSHALL, MO.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric-light plant. Henrici, Kent & Lowry, Reserve Bank Building, Kansas City, Mo., are engineers.

SMITHTON, MO.—The Council has awarded S. V. Monsees of Sedalia a contract for the installation of an electric-light plant in Smithton.

FORDVILLE, N. D.—The installation of an electric-lighting system in Fordville is under consideration. It is proposed to enlarge the electric plant in the Fordville garage to supply the service.

GARRISON, N. D.—A company is being organized to operate a lignite mine and furnish electricity in Garrison. The proposed plant will be equipped with a 125-hp. boiler, a 125-hp, steam engine and a 75-kw., 250-volt, direct-current generator. W. M. Robinson will be president and J. A. Kunkel manager of the company.

KATHRYN, N. D.—The Kathryn Farmers Mutual Elevator Company has engaged J. H. A. Brahtz of Mankato, engineer, to prepare plans for the construction of a fireproof grain elevator of the "Brahtz Perfection" type, 50,000 bushels capacity; fireproof flour mills, 50,000 bushels capacity, and electric power station. Contracts, it is understood, will be awarded about July 10. A. E. Michelsen is secretary.

MINOT, N. D.—Bids will be received by the board of education of Minot, until July 24 for construction of high school building, to cost about $150,000, including electric wiring, heating and plumbing, ventilating, etc. W. E. Hulse & Company of Hutchinson, Kan., are architects.

ALCESTER, S. D.—Bids will be received by A. A. Treick, city auditor, until July 19 for erection of an electric transmission line and distribution system for the city of Alcester. Earle D. Jackson, Capital Bank Building, St. Paul, Minn., is consulting engineer.

HARTFORD, S. D.—The County Commissioners have granted the Northern States Power Company of Sioux Falls a franchise to erect and maintain an electric transmission line between Sioux Falls and Hartford for a period of 20 years.

LA MOURE, S. D.—Preparations are being made for the erection of an electric plant and laundry building, 60 x 60 ft. M. A. Erickson, owner of the electric plant, will install a 75-kw. generator and Corliss engine to supply power for the laundry. Shadduck & Kloubee are owners of the laundry.

WOONSOCKET, S. D.—The installation of an ornamental lighting system in the business district is under consideration.

PAXTON, NEB.—Preparations are being made for the installation of a municipal electric-light plant, bids for which have been received.

PLYMOUTH, NEB.—The Village Board has appointed a committee to make investigations relative to the installation of a municipal electric-light plant.

VALENTINE, NEB.—Plans are under consideration for improvements to the municipal electric-light plant and extensions to the distribution system.

ALMENA, KAN.—Plans are being considered for rebuilding the municipal electric-lighting plant.

BLAIRSBURG, KAN.—The Iowa Falls (Iowa) Electric Company has applied for a franchise to supply electricity in Blairsburg.

BLUE RAPIDS, KAN.—The City Council has granted the Marshall County Power & Light Company a franchise to construct a new electric plant and heating system in Blue Rapids.

ELLIS, KAN.—The City Council is considering calling an election to vote on the proposal to issue bonds for the installation of an additional generating unit in the municipal electric-light plant. The cost is estimated at about $5,000.

GARFIELD, KAN.—A. M. Moe, owner of the electric-light plant in Kingsley, has applied for a franchise to erect a transmission line and distribution system in Garfield.

HOWARD, KAN.—An election will soon be called to vote on the proposal to issue $4,000 in bonds for the installation of an electric-lighting system.

McCRACKEN, KAN.—The City Council is contemplating the installation of a municipal electric-light plant.

NETAWAKA, KAN.—An election will be held July 21 to submit to the voters the proposal to issue $8,000 in bonds for a municipal electric-light plant. A similar proposition has been twice defeated.

NORCATUR, KAN.—The Council has closed a contract with the town of Oberlin to secure electrical service from the municipal plant there.

OSAGE CITY, KAN.—Plans are being prepared by H. W. Underhill, architect, Bryant Building, Kansas City, Mo., for new municipal power house and pumping station. New equipment including two 80-hp. boilers, G. & G. ash hoist, etc., will be installed.

RAMONA, KAN.—The Riverside Light, Power & Gas Company of Abilene has been granted a franchise to supply electricity in Ramona for commercial purposes.

Southern States

APEX, N. C.—Bonds to the amount of $12,000 have been voted for the installation of an electric-lighting system in Apex.

KERNERSVILLE, N. C.—Bonds to the amount of $10,000 have been voted for the installation of an electric-lighting plant, water-works and sewer system.

WILSON, N. C.—The Board of Commissioners has ordered all telephone, telegraph and electric-light wires to be placed underground in the business section of the city.

CHARLESTON, S. C.—Bids will be received by the Combahee Corporation, Consolidated Company Building, Charleston, S. C., until July 26 for furnishing and installing a pumping plant for land drainage as follows: Two pumping units, each consisting of internal-combustion engine, pump, suction and discharge pipes and necessary auxiliaries, the total capacity of two pumps to be 35,000 gal. per minute at a static head of 3 ft.

COCHRAN, GA.—The Council has engaged William Crook, Grand Building, Macon, Ga., engineer, to prepare plans for improvements to the municipal electric-light plant, for which $3,000 in bonds were recently voted.

JACKSONVILLE, FLA.—Bids will be received by the Board of Port Commissioners, Room 405, Realty Building, Jacksonville, until July 24 for furnishing not less than six or more than twenty-four electric trucks of from one to four tons capacity, suitable for handling cotton in bales, etc., and for miscellaneous merchandise; also for the same number and capacity for same purposes, that can be used as combination trucks and tractors, pulling trailers attached in addition to handling a load on trucks; also for from six to forty-eight trailers suitable for use with the trucks as tractors, handling the same class of loading as described for handling by trucks. For details see proposal columns.

NEWTON, TENN.—The Newton Light & Power Company, recently incorporated with a capital stock of $2,500, proposes to furnish electrical service in Newton. W. A. Prince, J. E. Cook and J. D. Clemmer are interested in the company.

GURLEY, ALA.—The Alabama Power Company of Birmingham, has applied to the Public Service Commission for permission to take over the local electric plant.

LINEVILLE, ALA.—The Alabama Power Company has petitioned the Public Service Commission for authority to take over the electric-light plant in Lineville.

HOPE, ARK.—The City Council is contemplating a number of extensions and improvements to the street-lighting system.

WEST MONROE, LA.—Bonds to the amount of $45,000 have been voted for improvements and extensions to the municipal electric-lighting and water-works systems; also to install additional apparatus for fire protection.

CHATTANOOGA, OKLA.—The installation of an electric-light plant in Chattanooga is under consideration. A. A. Pyle is reported interested.

CRESCENT, OKLA.—Application has been made to the City Council by Mr. Askins to install an electric-light plant (to cost about $7,500) in Crescent.

TULSA, OKLA.—Bids will be received at the office of George Winkler, architect, Palace Building, Tulsa, until July 20, for the erection of five additional stories to the Palace Building, to cost about $80,000. The work, it is understood, will include steam heating, electric wiring, two electric passenger elevators, vacuum cleaner for the entire building, electric generating set, etc.

DALLAS, TEX.—Permission has been granted the Mackay Telegraph Company to lay conduits in the streets of the city for long-distance telephone wires.

EL PASO, TEX.—The El Paso Electric Company is planning to place all overhead wires in the business district in underground conduits. The cost is estimated at $325,000.

HOUSTON, TEX.—The Houston, Richmond & Western Traction Company, it is reported, is contemplating the construction of a power house in connection with its proposed railway between Houston and San Antonio.

MARLIN, TEX.—Surveys are being made by the Temple & Marlin Interurban Railway Company for the construction of an electric railway from Marlin to Temple.

PALESTINE, TEX.—The Texas Power & Light Company is contemplating extending its transmission lines from Palestine to the salt works, 5 miles east of here.

SAN ANGELO, TEX.—The San Angelo Water, Light & Power Company is erecting a transmission line from San Angelo to Rowena, a distance of about 25 miles.

SHERMAN, TEX.—Bonds to the amount of $20,000 have been voted, of which the proceeds of $10,000 will be used for a new street-lighting system and the remainder for a fire-alarm system.

SHINER, TEX.—The State attorney general has approved an issue of $12,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant in Shiner.

TEXAS CITY, TEX.—The Lawrence Electric Company of Galveston has been awarded the contract for installing new street-lighting system at $4,599.

Pacific States

PALOUSE, WASH.—The Washington Water Power Company has petitioned the City Council for a 25-year franchise in Palouse. The present franchise of the company has yet 12 years to run. If granted an extension of its franchise the company agrees to rebuild the local system.

SPOKANE, WASH.—Plans and specifications are being prepared for the installation of the proposed ornamental lighting system on Main Street, from Division to Monroe, by Morton McCartney, city engineer.

STANWOOD, WASH.—Warren Marshall of Boston, Mass., has submitted a proposal to the City Council offering to take over the property of the Stanwood Light & Power Company, providing the necessary franchise will be granted by the city.

ASTORIA, ORE.—The Port of Astoria, it is reported, will soon ask for bids for the installation of a power and electric-lighting service in the new grain elevator now under construction, to cost about $60,000.

OREGON CITY, ORE.—The Willamette Valley Southern Railway Company, it is reported, contemplates extending its railway to Silverton this fall.

PORTLAND, ORE.—Bids, it is reported, will soon be asked by R. L. Barbur, city auditor, for furnishing a multi-stage turbine pump, directly connected to a 200-hp. electric motor.

SILVERTON, ORE.—The Silver Falls Timber Company, it is reported, will equip its railroad from Silverton to its logging camps for electrical operation.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is contemplating extending its electric railway from Los Angeles to San Diego via Fullerton, Anaheim and Santa Ana.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 29 for furnishing one electric freight elevator at the navy yard, Mare Island, Cal.

MARTINEZ, CAL.—The board of trustees is reported to have granted the Martinez-Concord Interburban Railroad Company a franchise to construct the first unit of proposed railway to connect the two cities.

OCEANSIDE, CAL.—Extensions and improvements are contemplated to the system of the Oceanside Electric Company, which was recently taken over by the San Diego (Cal.) Consolidated & Gas Company. Surveys have been completed for the erection of a transmission line from the San Diego company's line in Del Mar to Oceanside. A 24-hr. service will be established here when improvements are completed.

VISALIA, CAL.—The Pacific Light & Power Company, of Los Angeles, which recently took over the holdings of the Mount Whitney Power & Electric Company of Visalia, it is reported, has decided upon the location of the new substation, to utilize energy from the Big Creek lines and also to serve as a distributing station in Visalia County. E. R. Davis of Los Angeles is general manager of the Pacific company.

BURLEY, IDAHO.—The town of Burley is reported to be considering an issue of $40,000 in bonds, the proceeds to be used to extend and improve the electric-lighting system and water-works.

COEUR D'ALENE, IDAHO—A special election will soon be called to submit to the voters the proposal to issue $230,000 in bonds for a municipal electric-light plant and water-works system.

COLTON, IDAHO.—The Washington Water Power Company is establishing a substation in Colton, from which a transmission line will be erected to Johnson to furnish electrical service there. Electricity will also be supplied to farmers residing along the line.

NAMPA, IDAHO.—The Oregon Short Line Railway Company, it is reported, is preparing to construct a new roundhouse at Nampa. The plans provide for an electrically operated turntable.

BOUSE, ARIZ.—The Ne La Paz Coal Mining Company is contemplating the construction of an electric plant and the erection of transmission lines to various mining camps in this district.

DUNCAN, ARIZ.—The Carlisle Mining Company is reported contemplating the construction of a power plant in Duncan, and also building an electric railway from Duncan to its mines at Steeplerock, a distance of 13 miles. H. K. Welch of Steeplerock, N. M., is manager.

GLOBE, ARIZ.—The Old Dominion Copper Mining & Smelting Company is contemplating the erection of a tile hospital building; also the installation of additional equipment at the concentrator and power house, including grinding mills and flotation machines.

PRESCOTT, ARIZ.—The Arizona Hydraulic Power Company contemplates the construction of a storage dam and electric power plant on Verde River and the erection of a transmission line to Miami, a distance of 70 miles. E. H. Meek is manager.

PRESCOTT, ARIZ.—Plans are being prepared, it is reported, by E. P. Thayer of Prescott for the construction of a power plant on Burro Creek, western Tavapai County, and the erection of transmission lines to the Oatman mining district, 70 miles long, and to other mining districts.

BAKER, MONT.—The Beaver Valley Electric Railway Company is planning to construct an electric railway from Baker to Ekalaka via Webster, a distance of 50 miles.

HARDIN, MONT.—Surveys are being made by the Big Horn Canyon & Irrigation Company for the construction of a dam near Hardin. It is proposed to build a larger dam than was originally intended and increase the amount of land to be irrigated and the amount of power to be generated.

ROUNDUP, MONT.—Preparations are being made by Carl H. Jensen of the Butte (Mont.) Electric Supply Company for the installation of an electric-lighting system in Roundup. The contract for installing the lamps is held by E. T. Barron of Butte.

Canada

STELLARTON, N. S.—The installation of a 3000-kw. steam turbine is under consideration by the Arcadia Coal Company of Stellarton. F. Mosebaert of Stellarton is chief engineer.

WOLFVILLE, N. S.—Work has been started by the Cape Split Development Company of Wolfville on the Bay of Fundy power project at Cape Split. The project will include a central station and about 175 miles of transmission lines. The plans provide for an initial development of 37,500 hp. R. P. Clarkson of Wolfville is managing director.

GUELPH, ONT.—The installation of an additional 750-kva. transformer in the Huslisson Street station has been decided upon by the Light and Heat Commission.

ORILLA, ONT.—The Water, Light and Power Commission has engaged C. E. Fitton to make a survey for the proposed new transmission line to the water-works plant. It is proposed to erect a high-tension transmission line direct to the pumping station by connecting up with one of the transmission lines extending to the substation.

PEMBROKE, ONT.—Plans are being prepared by R. S. Kelsch, Power Building, Montreal, for a substation for the Pembroke Electric Light Company.

SCARBOROUGH, ONT.—The Township Council has decided to erect a transmission line to Agincourt.

BEAUHARNOIS, QUE.—Plans are being prepared by R. S. Kelsch, Power Building, Montreal, for an extension to the power plant of the Howard Smith Paper Company.

CRABTREE MILLS, QUE.—Plans are being prepared by R. S. Kelsch, Power Building, Montreal, for the construction of a dam and power plant for the Crabtree Paper Company, to cost about $70,000.

MAGOG, QUE.—Plans are being prepared by R. S. Kelsch, Power Building, Montreal, for the construction of power plant and dam for the Dominion Textile Company, to cost about $75,000.

MONTREAL, QUE.—The Ogilvie Flour Milling Company, Youville Place, Montreal, is contemplating the construction of a hydraulic power plant, to cost $80,000.

QUEBEC, QUE.—Tenders will soon be asked by the Quebec Exhibition Commission, City Hall, Quebec, for the installation of a lighting system at the Exhibition Grounds, to cost about $11,000.

ESTEVAN, SASK.—A by-law will be submitted to the ratepayers appropriating $5,000 for the completion of the electric power plant.

WATROUS, SASK.—The Watrous Electric Light Company is contemplating the installation of a new gas producer plant.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 20 for furnishing power plants for supply boats, motor boats, pump casing and heads, pipe threading and cutting machine, babbitt metal, sheet brass, copper wire, storage batteries, magnesia pipe covering, etc. Blanks and general information relating to this circular (No. 1058) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,188,396. Method of and Apparatus for Regulating the Commutating Field in Direct-Current Commutator Machines; L. Binder, Charlottenburg, Germany. App. filed Sept. 28, 1911. Weakens the field strength of the poles with increasing speed of the machine.

1,188,408. Dry Cell and Battery Thereof; C. F. Burgess, Madison, Wis. App. filed May 28, 1915. Metal connecting cap fitted over end of cell.

1,188,438. Electric Switch; G. Goldman and G. F. Sturgeon, Chicago, Ill. App. filed April 8, 1914. For shunting out any light whose circuit becomes broken.

1,188,451. Ignition Timer; E. M. Jacobson, Pittsfield, Mass. App. filed Oct. 29, 1915. Novel construction of rotating element.

1,188,460. Alarm for Safety Chests; M. E. Launbranch, Chicago, Ill. App. filed Dec. 15, 1908. Operates when jewel or other chest is lifted or tilted.

1,188,520. Electric Hot-Water-Storage Installation; C. W. Winterbotham, Brighton Beach, Melbourne, Victoria, Australia. App. filed July 3, 1915. Immersion heater with special circulating means.

1,188,531. Duplex Wireless System; J. R. Carson, New York, N. Y. App. filed Sept. 27, 1915. Duplex communication carried on automatically.

1,188,556. Electrical Water Heater; G. M. Patterson, Fairfield, Me. App. filed Jan. 13, 1915. Special construction of heating tubes or coils.

1,188,564. Electrically Operated Musical Instrument; M. L. Severy, Arlington Heights, Mass., and G. B. Sinclair, Georgetown, Me. App. filed May 17, 1912. Electro-magnetic vibrating and dampening means.

1,188,568. Terminal Box and Plug; E. G. Smith, Syracuse, N. Y. App. filed Oct. 28, 1911. Particularly adapted for railway cars.

1,188,570. Power System; V. O. Strobel and S. Buckley, Philadelphia, Pa. App. filed May 29, 1913. When not in service locomotives are operated to supply current to the line.

1,188,574. Vapor Rectifier; T. H. Thomas, East Orange, N. J. App. filed March 5, 1903. Induction coil in shunt circuit.

1,188,575. Single-Phase Gas or Vapor Electric Device; T. H. Thomas, Montclair, N. J. App. filed June 13, 1903. Means for supplying extra initial potential.

1,188,577. Mercury Vapor Apparatus; P. H. Thomas, Upper Montclair, N. J. App. filed Nov. 24, 1911. Necessary cooling surface near the cooling path.

1,188,578. Mercury Vapor Apparatus; P. H. Thomas, Upper Montclair, N. J. App. filed Nov. 24, 1911. Necessary cooling surface near the cooling path.

1,188,579. Method of Operating Vapor Electric Apparatus; P. H. Thomas, Upper Montclair, N. J. App. filed Nov. 4, 1907. Utilizes a shunt path to the main load.

1,188,580. System of Car Operation by Vapor Converters; P. H. Thomas, Upper Montclair, N. J. App. filed Aug. 2, 1905. Converters in parallel in direct-current motors in multiple or series.

1,188,587. Vapor Electric Apparatus; M. Von Recklinghausen, Suresnes., France. App. filed July 12, 1913. Quartz container with titumzicim.

1,188,591. Direction-Indicator for Motor Vehicles; J. E. Whipple, Columbus, Ohio. App. filed Oct. 5, 1915. Solenoid operated semaphores.

1,188,593. Electric Meter; C. M. Wild, Springfield, Mass. App. filed Dec. 12, 1914. Safeguards ammeter against abnormal currents.

1,188,597. Method and Apparatus for Rectifying Alternating Current; E. R. Wolcott and F. Rieber, Los Angeles, Cal. App. filed Aug. 3, 1914. Obviates expense of vacuum tubes.

1,188,599. Self-Tying Insulator; S. L. Youmans and J. A. McLaughlin, Jesup, Ga. App. filed July 29, 1915. Wire is tied by simply throwing it into notch in insulator.

1,188,603. Refrigerator Alarm; H. Amrheim, South Bethlehem, Pa. App. filed June 25, 1915. Special drip pan alarm.

1,188,621. Cigar Lighter; E. Brunhoff, Cincinnati, Ohio. App. filed Jan. 22, 1914. Improved means for igniting an extinguishing torch.

1,188,635. Carbon-Brush Connection; H. B. Eynon, East St. Louis, Ill. App. filed May 7, 1914. Copper amalgam filled in cavity.

Record of Electrical Patents

Notes on United States Patents issued June 27, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,188,645. Signaling System; C. Greenslit, Cleveland, Ohio, and R. Royal, Chicago, Ill. App. filed Sept. 11, 1913. Automatic distribution for plurality of signals.

1,188,647. Means for Preventing Overheating Electric Resistances; E. Gruenfeldt, Cleveland, Ohio. App. filed Jan. 6, 1913. Fuse disposed between resistance sections.

1,188,652. Electrical Relay; S. B. Hess, New York, N. Y. App. filed July 8, 1914. Armature and contact construction.

1,188,653. Electrical Alarm System; S. B. Hess, New York, N. Y. App. filed July 8, 1914. Eliminates operation of battery and high voltage systems.

1,188,654. Electrical Apparatus; S. B. Hess, New York, N. Y. App. filed Dec. 28, 1914. Fire protection.

1,188,663. Vapor Electric Apparatus; M. A. E. Leblanc, Paris, France. App. filed Feb. 7, 1912. Reliable and continuous operation.

1,188,691. Mouthpiece; E. D. Spear, Boston, Mass. App. filed Jan. 26, 1915. Prevents others hearing words into telephones.

1,188,705. Process for the Recovery of Metals from Ores and the Like; C. S. Vadner, Butte, Mont. App. filed Feb. 14, 1916. Utilizes sulphurous fumes.

1,188,720. Coil-Winding Machine; A. Beutler, Chicago, Ill. App. filed May 19, 1915. Paper introduced between layers of wire.

1,188,734. Electrical Cooker; E. E. Clement, Washington, D. C. App. filed Sept. 16, 1911. Fireless type, automatic control.

1,188,749. Electric Testing Clip; H. Frankel, New York, N. Y. App. filed Feb. 21, 1916. Insulation pressing point attachable to clip.

1,188,761. Carbon-Brush Connection; C. Hambuechen, Belleville, Ill. App. filed April 17, 1914. Carbon block may be disconnected for renewal.

1,188,773. Vapor Electric Apparatus; P. C. Hewitt, Ringwood Manor, N. J. App. filed Sept. 9, 1912. Negative flame at surface of electrode.

1,188,774. Vapor Electric Apparatus; P. C. Hewitt, Ringwood Manor, N. J. App. filed Dec. 19, 1912. Special cooking means.

1,188,786. Safety Electric Fuse; S. W. Huff, Brooklyn, N. Y. App. filed April 27, 1914. Inclosed type with knife-blade terminals.

1,188,803. Loom Alarm; A. Marcante, Paterson, N. J. App. filed Jan. 11, 1915. Detector actuated by snarl or entanglement in the threads.

1,188,804. Common Battery Telephone Exchange System; T. G. Martin, Chicago, Ill. App. filed Dec. 16, 1905. Automatic or semi-automatic (ninety-four claims).

1,188,822. Float Controlled Circuit Closing Mechanism; W. S. Peters, Cement, Cal. App. filed Oct. 18, 1913. For gasoline tanks of autos.

1,188,877. Clock; G. J. Anderson, Greensboro, N. C. App. filed Oct. 13, 1915. Electromagnetically operated.

1,188,884. Controlling Mechanism for Dynamos, Motors, etc.; J. Bijur, New York, N. Y. App. filed Dec. 6, 1913. Adjustable relay for determining energy output.

1,188,905. Arrangement for Starting and Regulating Direct-Current Electric Motors; F. Cumont, Paris, France. App. filed June 6, 1912. Automatic starting and regenerative working.

1,188,906. Timer; C. H. Cuno, Meriden, Conn. App. filed Nov. 30, 1915. Construction of rotating timer element.

1,188,934. Street Indicator; C. C. Hays, Trinidad, Col. App. filed Sept. 17, 1915. For electric cars.

1,188,952. Electrical Water Heater; G. M. Laird, Hillsboro, Ill. App. filed Aug. 23, 1915. Portable for attachment to water faucet.

1,188,966. Automatic Interchangeable Circuit Breaker; W. S. Mayer, Taunton, Mass. App. filed May 2, 1914. Similar to ordinary cartridge fuse.

1,188,972. Electric Heating Element; F. W. Moffat, Weston, Ontario, Canada. App. filed April 20, 1916. For broiling oven.

1,189,001. Extension Telephone; D. G. Saunders, Jr., Kansas City, Mo. App. filed Oct. 3, 1914. Portable wall set which can be carried from room to room.

1,189,015. Binding Post; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 2, 1916. For rotary snap switches.

1,189,023. Treatment of Wheat and Other Cereals or Cereal Products; W. Watson, Dover, England. App. filed July 6, 1915. To obtain flour improvers and food products.

1,189,050. Dynamo Electric Machine for Combined Electric Lighting and Engine Starting; B. Brooks and W. Holt, Birmingham and Erdington, Birmingham, England. App. filed Nov. 9, 1914. Armature has two windings for operation with magnet system of different number of poles.

1,189,065. Light Signal; D. M. Crooker, Port Huron, Mich. App. filed Dec. 2, 1913. Light flashes with blowing of whistle on boat.

1,189,070. Wireless Telegraphy; B. V. Deitz, Slingerlands, N. Y. App. filed May 6, 1914. Two or more signals without interference.

1,189,076. Automobile Signal; E. N. Eisendrath and M. Leishin, Denver, Col. App. filed July 20, 1915. Semaphore at side of wind shield.

1,189,088. Bracket for Electrical Wire Constructions; G. S. Gardner, Columbus, Ohio. App. filed July 29, 1915. Special means for securing it to crossarm.

1,189,109. Electrical Measuring Instrument; F. Holden, London, England. App. filed Oct. 11, 1913. Means to prevent the "constant" of the meter from varying.

1,189,116. Electric Railway Switch Signaling Device; A. M. Johnson, Cleveland, Ohio. App. filed June 1, 1914. Connected to switch point.

1,189,160. Wire Holding Means for Electric Conductors; O. E. Monroe, St. Louis, Mo. App. filed March 30, 1915. Eliminates the necessity of "tying in."

1,189,161. Wire Lifter and Spacer; O. E. Monroe, St. Louis, Mo. App. filed March 30, 1915. For holding the wires while replacing insulators.

1,189,177. Mechanism for Operating Railway Block Signals; B. C. Rowell, deceased, Chicago, Ill. App. filed July 14, 1910. Especially for single-track roads.

1,189,179. Pigtail Connection; W. Shaw, Lakewood, Ohio. App. filed Aug. 6, 1912. Readily removable but cannot work loose.

1,189,180. Electric Machine; F. C. Sinback, Littleton, Ala. App. filed May 14, 1914. Coal mining motor with improved structural features.

1,189,181. System of Electric Power Transmission; A. Stauch, near Berlin, Germany. App. filed Jan. 9, 1915. Polyphase induction motors.

1,189,182. Voltage Regulator; L. W. Thompson, Buffalo, N. Y. App. filed April 1, 1914. Eliminates the usual lapse of time in bringing voltage back to normal.

1,189,183. Signal; R. R. Thompson, Los Angeles, Cal. App. filed April 5, 1915. Semaphore construction.

1,189,184. Dental Drill; H. A. Whiteside, New York, N. Y. App. filed June 30, 1909. Mounting of motor on drill handle.

1,189,193. Motor Controlling Arrangement; F. Cumont, Paris, France. App. filed July 9, 1914. Automatic starting and regenerative action.

1,189,208. Conduit for Electric Wires; F. C. Hodkinson, Pittsburgh, Pa. App. filed Jan. 15, 1912. Metal molding construction.

1,189,213. System for Electrically Setting the Sights of Guns; A. H. Wegner, Washington, D. C. App. filed May 2, 1912. Impulses transmitted from a keyboard to the sights of a number of guns in parallel.

14,158 (Reissue). Controller for Electric Motors; L. G. Riley, Wilkinsburg, Pa. App. filed May 8, 1916. Original, No. 1,157,904, dated Oct. 26, 1915. Series multiple railway system.